Profiles on Adolescent Internet Addiction: A Taxonomy with Latent Profiling Analysis

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ABSTRACT

Introduction: Addictive use of the Internet among adolescents has been linked to a negative psychosocial development, but more detailed information about Internet addiction (IA) profiles is warranted. The aim of this study was to identify IA profiles in adolescents based on psychometric properties from the Internet Addiction test (IAT), and to assess the associations between the profiles and personal/social behaviors.

Material and Methods: A cross-sectional study was performed at public schools from a Portuguese region, using a survey that included the IAT. We performed a latent profiling analysis to identify the profiles of adolescent based on the six IAT dimensions.

Results: From the 1915 responses, students’ mean age was 15 ± 1.82 years, 53% were female. IA was found in 16.5%. Four models were estimated with latent profiling analysis. Analysis of the models by fit statistics, integrated completed likelihood and Lo-Mendell-Rubin likelihood ratio test, indicated a better solution with four profiles: Profile 1 – Worrisome lack of control users, Profile 2 – Balanced users, Profile 3 – Worrisome anticipation users, Profile 4 – Problematic users.

Conclusion: This study provides a characterization of different patterns in adolescents’ traits and behaviors associated with Internet addiction. Preventive approaches may be useful to reduce IA.

Keywords: Adolescent; Adolescent Behavior; Internet Addiction Disorder; Online Social Networking; Portugal

INTRODUCTION

Technology is fast evolving with enhanced access to all kinds of information and resources through the Internet. It has become an essential tool in our daily social, professional, and academic life, among others. However, its excessive use has raised concerns about potential harmful health-related consequences, especially within vulnerable groups, such as adolescents. It is estimated that close to 75% of European adolescents spend up to four hours a day on online activities. Moreover, since they have not entirely developed their critical thinking skills and sense of boundaries, addiction is more likely in this age group. Kimberly Young firstly mentioned Internet addiction (IA) in 1996. Although ongoing research continues on this subject, IA classification is still controversial, with empirical studies providing inconsistent criteria to define IA. Different scales have been used to assess IA, of which Young’s Internet Addiction test (IAT) is one of the most used and accepted. This test evaluates the degree to which Internet use affects daily routine, social life, productivity, sleeping patterns, and feelings. In Portugal, few studies have reported adolescent IA rates, ranging roughly from 16% - 19%. This trend was slightly higher than the previously reported margins of Internet addiction, using the same tool.

Several studies using the IAT have shown a negative impact of Internet addiction in adolescents’ psychosocial development, affecting academic performance, family relationships, and emotional development. Most of the evidence on the effects of excessive Internet use concerns health, namely obesity and lack of sleep. More recently, a focus on the influence of parental control and other...
psychosocial factors on IA has been explored, with results indicating a negative association with parental control. When students reported having any parental control over their Internet use, Internet addiction was less likely to occur.\(^6\)

To better understand how psychologic factors may influence the risk of IA, studies were conducted to assess the widely used psychometric properties of the IAT. From these, six main dimensions that factor heavily on IA were identified – salience, excessive use, neglect of work, anticipation, lack of control, and social life neglect. Salience, excessive use, lack of control, and social life neglect are positively correlated with increased Internet use. Similarly, younger and more recent Internet users were shown to have more problems with neglecting work or social life than longer-term users.\(^11\)

Since these issues are a growing concern in our modern world, identifying contributing factors is essential to improve prevention and intervention in IA. Hence, the aims of our study are to ascertain different patterns in the characteristics and behaviours of adolescents with Internet addiction in order to identify profiles; identify which psychometric properties from the IAT are correlated with personal and social behaviours in our sample of adolescents.

MATERIAL AND METHODS

Study design and sample

An observational and analytical cross-sectional survey-based study was performed in the public schools of Cova da Beira region. Both elementary and secondary schools, accounting for 3788 students from grades seven through 12, were invited to participate. Approval by the Portuguese Ministry of Education and the Portuguese Data Protection Authority was obtained before the study. Written consent was obtained from all participants or, where it was applied, from their legal guardians. Participating students were asked to fill in a questionnaire under their teacher’s supervision. The questionnaire had three different sections. The first one addressed sociodemographic factors, health-related questions, and lifestyle habits regarding Internet usage in and out-of-school. The second and third sections consisted of two scales that approached general well-being and Internet addiction risk. Students who did not get/return a signed consent form and those older than 17-years and 365 days were excluded from the study.

Internet addiction assessment

Internet Addiction was assessed by using a previously validated Portuguese version of Young’s Internet Addiction Test,\(^2\) which consisted of 20 questions with possible answers ranging from “1” (Never) to “5” (always), along with the “not applicable” option of “0”.\(^2\) Since each question followed a Likert-scale answer, the cut-off of > 2.5 points was established to ascertain an increased usage of Internet (as seen in Fig. 1). The maximum collective score was 100, with higher values indicating greater risk from Internet usage.\(^12\)

Average Internet users (IAT 0 - 50) and Internet-addicted users (IAT 51 - 100) were characterized accordingly. The collected data produced a highly consistent internal reliability (Cronbach \(\alpha = 0.85\)). The IAT is composed of 20 items.

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**Figure 1 – Means by profile**

*: green-dashed line represents the cut-off for increased Internet use
and was primarily developed as a unidimensional instrument. Meanwhile, different validations have shown a factor structure with a variable number of dimensions. Kimberly Young recommended six dimensions.\textsuperscript{13,14} 
- Salience (items 10, 12, 13, 15, and 19) - high scores on these items suggest that the “respondent most likely feels preoccupied with the Internet, hides the behavior from others, and may display a loss of interest in other activities and/or relationships only to prefer more solitary time online”;
- Excessive Use (items 1, 2, 14, 18, and 20) - High ratings on these questions indicate that the “respondent engages in excessive online behavior and compulsive usage, and is intermittently unable to control time online that he or she hides from others”;
- Neglect Work (item 6, 8, and 9) – the subjects’ “performance and productivity are most likely compromised due to the amount of time spent online and the respondent may become defensive or secretive about the time spent online”;
- Anticipation (items 7 and 11) - indicates that “respondent most likely thinks about being online when not at the computer and feels compelled to use the Internet when offline”;
- Lack of Control (items 5, 16, and 17) - high scores on these items suggest that the “respondent has trouble managing his or her online time, frequently stays online longer than intended, and others may complain about the amount of time he or she spends online”;
- Neglect Social Life (item 3 and 4) - the subject “most likely uses online relationships to cope with situational problems and/or to reduce mental tension and stress.” and “uses the Internet to establish social connections that may be missing in his or her life”.

General demographics

General sociodemographic data were obtained alongside specific psychosocial variables (Table 1). An adequate amount of sleeping time during weekdays was classified according to the guidelines of the American Academy of Pediatrics and presented as recommended (9 - 12 hours in children aged 8 - 12 years, and 8 - 10 hours for children aged 13 - 18 years) or less than recommended.\textsuperscript{15} Parental behaviour was assessed by asking participants if their parents controlled overall Internet use and online time, and online-viewed content.

### Latent profile analysis

We performed a latent profile analysis\textsuperscript{16} (LPA) using the Mclust package\textsuperscript{17} with R version 3.5.3 (R Core Team 2019) to identify profiles of teenagers with similar values in the six Internet addiction dimensions. LPA is a latent variable technique with the same objective as cluster analysis - to identify groups of observations with similar values on grouping variables\textsuperscript{18} but with the difference that LPA is model-based and cluster analysis is not.\textsuperscript{19} Therefore, LPA has the advantages of (1) accommodating data with a variety of forms; (2) using more rigorous criteria to decide the final model, including fit measures; (3) using the model parameter estimates of one sample to compute the posterior probabilities and assign cluster membership to observations in other samples.\textsuperscript{19} This latter advantage allows the classification of individuals into the groups in posterior studies.

### RESULTS

**Descriptive statistics**

A total of 1915 eligible responses were obtained. The participants’ mean age was 15 years (SD = 1.82). The prevalence of IA was 16.5% in our sample, with a mean average IAT score of 39 (SD = 12).

All correlation coefficients between IAT dimensions and IAT score were statistically significant (Table 1). The highest correlations were obtained between IAT score and neglect social life (0.84) and salience (0.78), followed by the correlation between excessive use and lack of control (0.58), and then excessive use and salience (0.55). The lowest correlation was verified between anticipation and neglect of social life (0.21). Age was positively correlated with IAT score and all IAT dimensions, except salience and lack of control. BMI z-scores showed no significant correlation with IAT.

As shown in Table 2, there was a slight predominance of females; 24% of the students self-reported health issues and 46% reported not practicing any extracurricular sports activities. The majority stated they slept well and had no

### Table 1 – Descriptive statistics and correlations. Mean, standard deviation, distribution, and correlation across IAT dimensions.

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Mean</th>
<th>Median</th>
<th>SD</th>
<th>Histogram</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Salience</td>
<td>1915</td>
<td>1.91</td>
<td>1.8</td>
<td>0.76</td>
<td>▁▁▁▁▁</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Excessive Use</td>
<td>1915</td>
<td>1.95</td>
<td>1.8</td>
<td>0.69</td>
<td>▁▁▁▁▁</td>
<td>0.55*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Neglect Work</td>
<td>1915</td>
<td>1.78</td>
<td>1.8</td>
<td>0.76</td>
<td>▁▁▁▁▁</td>
<td>0.40*</td>
<td>0.52*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Anticipation</td>
<td>1915</td>
<td>2.21</td>
<td>1.8</td>
<td>0.93</td>
<td>▁▁▁▁▁</td>
<td>0.48*</td>
<td>0.46*</td>
<td>0.36*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Lack of Control</td>
<td>1915</td>
<td>2.28</td>
<td>1.7</td>
<td>0.91</td>
<td>▁▁▁▁▁</td>
<td>0.46*</td>
<td>0.58*</td>
<td>0.43*</td>
<td>0.39*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Neglect Social Life</td>
<td>1915</td>
<td>1.52</td>
<td>2</td>
<td>0.88</td>
<td>▁▁▁▁▁</td>
<td>0.31*</td>
<td>0.26*</td>
<td>0.23*</td>
<td>0.21*</td>
<td>0.12*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. IAT</td>
<td>1915</td>
<td>1.71</td>
<td>2.3</td>
<td>0.67</td>
<td>▁▁▁▁▁</td>
<td>0.78*</td>
<td>0.48*</td>
<td>0.38*</td>
<td>0.41*</td>
<td>0.34*</td>
<td>0.84*</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Age</td>
<td>1915</td>
<td>15</td>
<td>15</td>
<td>1.82</td>
<td>▁▁▁▁▁</td>
<td>0.01</td>
<td>0.07*</td>
<td>0.15*</td>
<td>0.07*</td>
<td>-0.07*</td>
<td>0.20*</td>
<td>0.14*</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9. BMI (z-score)</td>
<td>1775</td>
<td>0</td>
<td>-0.02</td>
<td>0</td>
<td>▁▁▁▁▁</td>
<td>0.00</td>
<td>-0.03</td>
<td>0.03</td>
<td>-0.02</td>
<td>-0.02</td>
<td>0.04</td>
<td>0.03</td>
<td>0.24*</td>
<td>1</td>
</tr>
</tbody>
</table>

\* Pearson correlation with \( p < 0.01 \); 1: Salience; 2: Excessive Use; 3: Neglect Work; 4: Anticipation; 5: Lack of Control; 6: Neglect Social Life; 7: IAT: Internet Addiction test; 8: Age; 9: BMI (z-score); Z-score for body mass index
difficulty making friends. Half of the students reported no parental control over their Internet use. It was noteworthy that the variable with a stronger association with IAT was parental control. Indeed, lack of parental control was significantly associated with higher scores on all IAT dimensions, except lack of control. While health problems showed no significant association with IAT, sleeping well and sports practice were associated with lower scores on some IAT dimensions.

**Model estimation and selection**

Profiles of teenagers with similar values in the six Internet Addiction dimensions were identified with latent profile analysis (LPA). Four models were estimated with LPA using maximum likelihood, ranging from two to seven profiles. We used three criteria to find the optimal latent profile solution. Firstly, we examined fit statistics (Table 5), namely the Akaike Information criterion (AIC) and the Bayesian Information criterion (BIC). Secondly, we considered overall uncertainty in posterior classification, assessed by entropy. Lastly, we considered model complexity, measured by the integrated completed likelihood – ICL. Finally, we used the Lo-Mendell-Rubin likelihood ratio test (LRT) and the bootstrap likelihood ratio test (BLRT) with p < 0.01. AIC, BIC, and ICL decreased until the model with four profiles. The five-profiles model showed low overall uncertainty in posterior classification, with entropy = 0.836. The classification accuracy of the model

The probabilities of correct classification of observations are shown in the main diagonal of Table 6, ranging from 0.893 to 0.997.

We conducted a supervised classification with eigenvalue decomposition discriminant analysis – EDDA to further assess the correct classification of observations. A model was fit with a randomly chosen training subsample. This model was then used to classify data in the testing subsample, with data assigned to the profile corresponding to the model with the highest posterior probability.

The classification accuracy of the testing subsample was 96%, as shown in Table 7. Classification accuracy is much greater than one-fourth of the achieved by chance when considering the maximum chance criterium of 50.6%. The value of Press’s Q = 1545.9 (N = 575, n = 552, K = 4) is greater than 6.63 (critical value from the chi-square distribution with one degree of freedom and confidence of 99%), thus confirming that results exceeded the classification accuracy expected by chance.

**Classification accuracy of the model**

The means for each Internet addiction dimension and the global IAT and profile size are plotted by profile in Fig. 1. Profiles are described in the following sub-sections:

Profile 1 – Worrisome lack of control users - the largest group, representing 52% of the sample’s teenagers (n = 997). This group scores negatively (less than 2.5, below the green, dotted bottom line) in all dimensions (Table 3), although close to the bottom line, hence its members are called worrisome lack of control users. Despite all these
users lacking control, they are just shy of positive values and feature the highest difference between neglect social life and the other dimensions. Neglect dimensions (both work and social life) have the smallest means in all profiles. Curiously, this profile also singles-out users with equal parental control rates or absence thereof (Table 4).

Profile 2 – Balanced users – This was the smallest group, representing 9% of the sample (n = 167). This group showed the smallest means in all six dimensions; therefore, it was named balanced users. Balanced users represent the most homogeneous group, with the smallest standard deviations for all the dimensions. Interestingly, characteristics such as female predominance and highest parental control rate, compared with other profiles, are noteworthy (Table 4).

Profile 3 – Worrisome anticipation users - includes almost one-fifth of the teenagers (18%, N = 354). This group has rather small means in most dimensions, scoring slightly higher in anticipation and excessive use. For that reason, the group was named worrisome anticipation users. Here we also highlight users with the least difficulty in making friends (Table 4).

Profile 4 – Problematic users - represents 21% of participants (N = 397). This group has the highest means of all the profiles, and most of them present values above the bottom line. Besides, it was the most heterogeneous group, with the highest standard deviation across all the dimensions. This group is the only one with positive means in the Internet addiction dimensions and a positive global IAT. In this profile, a slight predominance of the male gender, more difficulty in befriending, and lower parental control rate stood out compared with the other profiles (Table 4).

Table 3 – Means and standard deviations of Profiles and ANOVA tests

<table>
<thead>
<tr>
<th>Profile</th>
<th>SAL</th>
<th>EXU</th>
<th>NGW</th>
<th>ANT</th>
<th>LOC</th>
<th>NSL</th>
<th>IAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>1.85</td>
<td>1.91</td>
<td>1.88</td>
<td>2.19</td>
<td>2.46</td>
<td>1.44</td>
<td>1.96</td>
</tr>
<tr>
<td></td>
<td>(0.52)</td>
<td>(0.48)</td>
<td>(0.63)</td>
<td>(0.75)</td>
<td>(0.69)</td>
<td>(0.71)</td>
<td>(0.31)</td>
</tr>
<tr>
<td>P2</td>
<td>1.12</td>
<td>1.2</td>
<td>1.07</td>
<td>1.19</td>
<td>1.19</td>
<td>0.84</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>(0.22)</td>
<td>(0.23)</td>
<td>(0.16)</td>
<td>(0.32)</td>
<td>(0.26)</td>
<td>(0.45)</td>
<td>(0.13)</td>
</tr>
<tr>
<td>P3</td>
<td>1.44</td>
<td>1.56</td>
<td>1.22</td>
<td>1.84</td>
<td>1.50</td>
<td>1.37</td>
<td>1.49</td>
</tr>
<tr>
<td></td>
<td>(0.34)</td>
<td>(0.33)</td>
<td>(0.27)</td>
<td>(0.54)</td>
<td>(0.40)</td>
<td>(0.67)</td>
<td>(0.19)</td>
</tr>
<tr>
<td>P4</td>
<td>2.83</td>
<td>2.71</td>
<td>2.33</td>
<td>3.03</td>
<td>2.97</td>
<td>2.12</td>
<td>2.66</td>
</tr>
<tr>
<td></td>
<td>(0.81)</td>
<td>(0.81)</td>
<td>(0.95)</td>
<td>(1.11)</td>
<td>(0.99)</td>
<td>(1.18)</td>
<td>(0.33)</td>
</tr>
<tr>
<td>F</td>
<td>575.888</td>
<td>448.338</td>
<td>265.143</td>
<td>266.323</td>
<td>432.916</td>
<td>118.867</td>
<td>442.392</td>
</tr>
</tbody>
</table>

p-value

Standard deviations in parenthesis.
SAL: Salience; EXU: Excessive Use; NGW: Neglect Work; ANT: Anticipation; LOC: Lack of Control; NSL: Neglect Social Life; IAT: Internet Addiction test

Table 4 – Profiles’ description and chi-squared tests

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>%</th>
<th>Profile 1</th>
<th>Profile 2</th>
<th>Profile 3</th>
<th>Profile 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1019</td>
<td>53%</td>
<td>54%</td>
<td>59%</td>
<td>52%</td>
<td>49%</td>
</tr>
<tr>
<td>Male</td>
<td>891</td>
<td>47%</td>
<td>46%</td>
<td>40%</td>
<td>47%</td>
<td>50%</td>
</tr>
<tr>
<td>With health issues</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1443</td>
<td>76%</td>
<td>75%</td>
<td>81%</td>
<td>75%</td>
<td>76%</td>
</tr>
<tr>
<td>Yes</td>
<td>454</td>
<td>24%</td>
<td>25%</td>
<td>18%</td>
<td>24%</td>
<td>23%</td>
</tr>
<tr>
<td>Sleeps well</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>171</td>
<td>9%</td>
<td>10%</td>
<td>7%</td>
<td>7%</td>
<td>9%</td>
</tr>
<tr>
<td>Yes</td>
<td>1706</td>
<td>90%</td>
<td>90%</td>
<td>92%</td>
<td>93%</td>
<td>90%</td>
</tr>
<tr>
<td>Practices sports</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>873</td>
<td>46%</td>
<td>45%</td>
<td>44%</td>
<td>46%</td>
<td>48%</td>
</tr>
<tr>
<td>Yes</td>
<td>1035</td>
<td>54%</td>
<td>55%</td>
<td>54%</td>
<td>54%</td>
<td>51%</td>
</tr>
<tr>
<td>Hard to make friends†</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>1627</td>
<td>85%</td>
<td>85%</td>
<td>88%</td>
<td>89%</td>
<td>82%</td>
</tr>
<tr>
<td>Yes</td>
<td>276</td>
<td>15%</td>
<td>15%</td>
<td>11%</td>
<td>10%</td>
<td>17%</td>
</tr>
<tr>
<td>Parents control Internet*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>961</td>
<td>50%</td>
<td>50%</td>
<td>44%</td>
<td>46%</td>
<td>58%</td>
</tr>
<tr>
<td>Yes</td>
<td>943</td>
<td>50%</td>
<td>50%</td>
<td>54%</td>
<td>53%</td>
<td>41%</td>
</tr>
</tbody>
</table>

*: p < 0.01; †: p < 0.05; #: p < 0.1
We reported no significant higher levels of physical activity, sleep, and satisfactory peer relationships with lower levels of IA. We observed a slightly higher score on the excessive use criteria, perhaps reflecting the widespread use of the Internet in the youth’s daily life. This group had the highest proportion of females, and highest parental control. These results are in line with previous studies. A recent study reported that ‘healthy users’ of the Internet and smartphones also showed a higher proportion of females and a better psychosocial profile. Regarding health status, Suris et al. have reported that average Internet users reported health problems less frequently. However, this was not significantly different among IA profiles in our study.

Conversely, as seen in problematic users (Profile 4), male gender, low parental control, and difficulties befriending people have been implicated as important associated factors of Internet addiction. Recent studies indicate greater propensity of males to be addicted to the Internet. Also consistent with the literature is the greater influence of parental monitoring in Internet use-related problems in their children. Overall, the evidence shows that parental monitoring can prevent adolescents from becoming overinvolved on the Internet. We reported no significant highlights concerning sleep and sports in the balanced users’ profile. Nonetheless, other studies have associated better sleep, higher levels of physical activity, and satisfactory peer relationships with lower levels of IA. When looking at the ability to make friends, the problematic users’ profile exhibited hardship. Adolescents overinvolved on the Internet show instability in significant relationships and difficulty in other leisure experiences. Moreover, good peer relationships are correlated with low levels of Internet addiction, implying that adolescents with unsatisfactory peer relationships rely on the Internet to relieve their loneliness.

Our study also identified two specific groups of adolescents who singled-out a specific IAT dimension that was concerning. In the case of lack of control users (Profile 1), a trend towards an increased rate of lack of control regarding Internet use was seen. Poor control regarding Internet use has been associated with users’ increased sensitivity to rewards and, on the other hand, insensitivity towards punishments that derive from decision-making tasks. Moreover, effective regulation, which is how we self-regulate our actions, may change one’s emotional state, and may actively be involved in the development of addictive behaviors. Interestingly, a study reported that the ability to regulate affection predicted time using the Internet, whereas other psychological problems such as depression, loneliness, or social anxiety did not. Male adolescents in this group were also more prone to lack of control than females, which is congruent with males being more engaged in high-risk online behaviors.

Regarding anticipation as a troublesome problem (Profile 3), it is known that craving or anticipation of pleasurable relief is a subjective phenomenon, almost exclusively based on self-reports. Notwithstanding, craving criteria have been linked to behavioural addictions such as IA. In profile three, we noticed an increase in the score of anticipation criteria compared with other factors. Furthermore, this group was also linked to a lower degree of parental control of Internet use. As mentioned before, parental control has a protective effect on Internet addiction among adolescents and alludes to two different kinds of control – psychological and behavioural. The latter, which deals with solicitation and restriction actions, was shown to be a healthier approach by parents in order to keep their children’s addiction in check. Since anticipation is largely a behavioral problem, this group’s results may be associated with parental control status.

Given that IA relates to these worrisome psychological

**DISCUSSION**

In line with previous studies, our results indicated a significant rate of adolescents that are addicted to the Internet.

As previously reported, the six IAT dimensions were positively correlated. The highest correlation was obtained between lack of control and excessive use and between salience and excessive use. These results are corroborated by previous studies.

Collectively, we identified four main profiles of adolescents on different aspects of Internet addiction. Regarding balanced users (Profile 2), all dimensions exhibited small means, indicating a healthy use of the Internet. We observed a slightly higher score on the excessive use criteria, perhaps reflecting the widespread use of the Internet in the youth’s daily life. This group had the highest proportion of females, and highest parental control. These results are in line with previous studies. A recent study reported that ‘healthy users’ of the Internet and smartphones also showed a higher proportion of females and a better psychosocial profile. Regarding health status, Suris et al. have reported that average Internet users reported health problems less frequently. However, this was not significantly different among IA profiles in our study.

Conversely, as seen in problematic users (Profile 4), male gender, low parental control, and difficulties befriending people have been implicated as important associated factors of Internet addiction. Recent studies indicate greater propensity of males to be addicted to the Internet. Also consistent with the literature is the greater influence of parental monitoring in Internet use-related problems in their children. Overall, the evidence shows that parental monitoring can prevent adolescents from becoming overinvolved on the Internet. We reported no significant highlights concerning sleep and sports in the balanced users’ profile. Nonetheless, other studies have associated better sleep, higher levels of physical activity, and satisfactory peer relationships with lower levels of IA. When looking at the ability to make friends, the problematic users’ profile exhibited hardship. Adolescents overinvolved on the Internet show instability in significant relationships and difficulty in other leisure experiences. Moreover, good peer relationships are correlated with low levels of Internet addiction, implying that adolescents with unsatisfactory peer relationships rely on the Internet to relieve their loneliness.
traits it is important to consider what interventions are available to address these issues. Several studies have been conducted to assess how pharmacological and non-pharmacological therapies may mediate Internet addiction. Results have not been consensual or generalizable given different methodologies, especially in adults. However, in adolescents and young adults, the literature has shed light on how to tackle this matter, and family-based approaches seem to offer advantages in addiction. Family therapy focused on resolving conflicts, improving communication, reframing addiction symptoms, and discussing states of change showed significant reductions in Internet addiction severity. Conversely, correctional programs seem to be largely ineffective. Cognitive-behavioral and motivational interventions may also help mediate Internet addiction since they are already used effectively in other mental health conditions. Whenever modifiable risk factors for IA are identified, a few of which this study highlighted (eg.: low parental control, hardship in befriending), specific interventions should be taken into consideration when developing prevention and intervention strategies for IA.

Some limitations to our study should be noted. Firstly, this was a cross-sectional study, which means causal inferences cannot be established. Secondly, as this was a survey-based study with self-reported answers, a response bias needs to be considered. Participants using the self-report scales may misunderstand the questions or try to create a positive or negative impact by giving false or misleading responses depending on social desires. Finally, the sample was composed of students in public schools and may not represent all adolescents.

Despite limitations to this study, identifying clusters of adolescents with specific alarming symptoms toward a worsening IA can be a helpful tool for further research. Since this subject is an increasing problem among adolescents it is important to develop multidisciplinary preventative interventions for clinicians, families, schools, and students in order to enhance their awareness about the unfavourable traits of IA.

Table 7 – Results of the supervised classification

<table>
<thead>
<tr>
<th>Profile</th>
<th>Predicted in training (n = 1340)</th>
<th>Predicted in testing (n = 575)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1.</td>
<td>704</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>0</td>
<td>109</td>
</tr>
<tr>
<td>3.</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>16</td>
<td>0</td>
</tr>
</tbody>
</table>

Main diagonals contain correct classifications. Classification error in the training set is 2.9% and 4.0% in the testing set.

CONCLUSION

This study’s results are an important step in characterizing different patterns in adolescents’ characteristics and behaviors associated with Internet addiction and to raise awareness of preventive actions to decrease IA. Latent class analysis-based classification rather than total score-based classification may provide more accurate and detailed information about participants’ Internet addiction profiles.

Healthcare professionals dealing with adolescents should be aware of the increasing online and social media platforms emerging nowadays and should be involved in prevention efforts to help adolescents avoid Internet addiction disorder.

AUTHORS CONTRIBUTION

MVM: Conception/design of the work. Acquisition, analysis, and interpretation of data for the work. Draft of the paper and critical review.

RGR: Acquisition, analysis, and interpretation of data for the work. Draft of the paper and critical review.

PSC, SF: Conception/design of the work. Acquisition, analysis, and interpretation of data for the work. Draft of the paper and critical review.

PROTECTION OF HUMANS AND ANIMALS

The authors declare that the procedures were followed according to the regulations established by the Clinical Research and Ethics Committee and to the Helsinki Declaration of the World Medical Association updated in 2013.

DATA CONFIDENTIALITY

The authors declare having followed the protocols in use at their working center regarding patients’ data publication.

COMPETING INTERESTS

All authors report no competing interests.

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REFERENCES


