Introduction

The internet is an important modern means of obtaining information and communicating with others which has converted the world into a global village. At the same time, increasing internet use among adolescents is also likely to pose a major public health concern that is internet addiction (IA). The aim was to assess the prevalence of IA among school-going adolescents and factors associated with IA. Methods: A cross-sectional study was designed to survey adolescents studying in 8th to 11th standard of five schools of Vadodara. Information regarding sociodemography and various patterns of internet use were obtained using survey forms. IA test (IAT) was used to screen for IA. Descriptive analysis, univariate analysis, and logistic regression were done to analyze the data. Results: Seven hundred and twenty-four participants that completed IAT were analyzed. Internet use prevalence was 98.9%. Prevalence of IA was 8.7%. Male gender, owning a personal device, hours of internet use/day, use of smartphones, permanent login status, use of internet for chatting, making online friends, shopping, watching movies, online gaming, searching information online and instant messaging were found to be associated significantly with IA in univariate analysis. Internet use for online friendships was found to be a significant predictor of IA (odds ratio [OR] = 2.4), and internet use for searching information was found to be protective (OR = 0.20) against IA on logistic regression. Conclusions: IA is prevalent in the adolescent population and requires awareness and intervention. Characteristics of internet usage found to be associated with IA needs to be considered while developing strategies for interventions.

Keywords: Adolescent, internet addiction, school

Access this article online

How to cite this article: Anusha Prabhakaran MC, Patel VR, Ganjiwale DJ, Nimbalkar MS. Factors associated with internet addiction among school-going adolescents in Vadodara. J Family Med Prim Care 2016;5:765-9.

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Prabhakaran, et al.: Factors associated with internet addiction

Data were collected using self-administered survey forms which included sociodemographic information such as age, gender, class, and another questionnaire to seek information regarding patterns of internet use. This included information such as beginning age of internet use, owning personal device, duration of internet use per day, most used medium to access internet, login status, using internet for purposes such as chatting, online friendships, online relationships, shopping, for coursework, watching movies, watching news, online gaming, instant messaging, and searching information. The information regarding watching adult content was removed from the questionnaire as most schools did not permit for the same. IA test (IAT) was used to screen for IA. It is a 20-item self-report questionnaire answered on the five-point Likert-type scale (0= “Does not apply,” 1= “Rarely” to 5= “Always”). Items on the IAT measures in relation to internet use, compulsive behavior, academic difficulties, lack of competence at home, problems in interpersonal relations, and emotional problems. It has been validated for use in adult and adolescent populations and has good internal consistency as well as concurrent validity. In item seven of IAT, “How often do you check your E-mail before something else that you need to do?” we added the term instant messaging along with E-mail keeping in mind the current patterns of communication through internet. Total IAT score of ≥50 was categorized as IA. Statistical analysis was done using the Statistical Package for the Social Sciences (SPSS Version 14, SPSS Inc, Chicago IL; 2005). Chi-square tests were applied to find an association between IA and various categorical variables, and logistic regression analysis to find predictive factors for IA. Anonymity and confidentiality of the participants were maintained throughout the study. The study was conducted after obtaining prior approval from Ethics Committee of the institution.

Results

In total, 836 adolescents were surveyed. Nine reported not having used internet ever, so they were excluded from analysis. Internet use prevalence was 98.9%. Only 724 participants completed the IAT and were included in the subsequent analysis.

Out of 724, 411 (56.8%) were males. The mean age of participants was 14.5 years (standard deviation [SD] 0.96, range 13–17). One hundred and thirty (17.9%) were from 8th grade, 251 (34.6%) from 9th, 301 (41.5%) from 10th, and 51 (7%) from 11th grade. A personal device for internet use was owned by 63.6% of the participants. The mean age of onset of internet use was 11.3 years (SD 1.73). Participants who admitted to use internet for more than 4 h/day were 5.4%. Smartphone was owned by 60.6% and 27.9% kept a permanent log-in status. Participants reported using internet for chatting (55.2%), online friendships (22.7%), online relationships (6.6%), shopping (39.9%), preferred way of interacting with friends (23.5%), for doing coursework (34.5%), watching movies (33.1%) and news (19.1%), online gaming (35.4%), instant messaging (21%), and for searching information (73.9%).

The prevalence of IA was found to be 8.7% (63/724). The mean age of participants with IA was 12.5 years (SD 0.93, range 13–17). Male gender, owning a personal device, hours of internet use per day, use of smartphones, permanent login status, use of internet for chatting, online friendships, shopping, watching movies, online gaming, searching information online, and instant messaging were found to be significantly associated with IA on univariate analysis [Table 1]. Internet use for online friendships (odds ratio [OR] =2.4) was found to be a significant predictor of IA and internet use for searching information (OR = 0.20) was found to be protective against IA on logistic regression [Table 2].

Discussion

IA includes symptoms such as preoccupation with the internet, withdrawal symptoms, tolerance, unsuccessful attempts to control internet use, and continued excessive internet use despite the negative consequences. There is a loss of interest in previous hobbies, entertainment as a result of, and with the exception of, internet use. Internet is used to escape or relieve a dysphoric mood, and to hide internet use, person may lie to family members, therapists, or others.[15] The American Psychiatric Association has recently included Internet Gaming Disorder in the appendix of updated version of DSM-5. IA or Problematic Internet use has yet not been officially recognized as a disorder.[16]

IA has been linked to functional brain changes in the prefrontal cortex, temporal cortex, and ventral striatum and structural brain changes in parts of prefrontal cortex. The functional changes in prefrontal and striatal areas are observable when individuals with IA perform tasks measuring executive functions and cue reactivity. The prefrontal control processes are reduced in IA and found to be related to person’s loss of control over internet use.[17]

Psychological factors such as using internet to escape from self-dissatisfaction, to deal with stress, having a poor attention control, self-control, and emotional regulation along with individual temperaments have been found to be associated with the development of IA.[8,9] Significant associations have been observed between IA and high-risk behaviors among adolescents.[20] IAT was designed by Kimberly Young in 1998, and since then the internet usage has changed drastically.[11,14] Social networking sites such as Facebook, Twitter, Instagram, and instant messaging apps have become important means of communication and interaction. While earlier when the IAT was formed the possibility of internet controlling one’s mood, etc., was not a consideration, it has now been shown by an experiment using Facebook algorithms that altering what is shown to a user can change the kind of posts the user makes.[21] While the experimental evidence may not occur in real life, it indicates the virtual world comparison to old saying of “you are known by the friends you keep.” The IAT scale needs to be modified in lieu of changing trends of internet use.

IAT showed a good internal consistency in our study as interpreted from Cronbach’s alpha of 0.88. Prevalence of IA
Table 1: Internet addiction and internet use patterns - univariate analysis

|                         | Normal internet usage, n (%) | Internet addiction, n (%) | P   |
|-------------------------|------------------------------|---------------------------|-----|
| Personal device         |                              |                           |     |
| No                      | 249 (37.96)                  | 12 (19.68)                | 0.005|
| Yes                     | 407 (62.04)                  | 49 (80.32)                |     |
| Duration of use (h)     |                              |                           |     |
| 0-2                     | 533 (83.67)                  | 34 (53.97)                | <0.0001|
| 2-4                     | 77 (12.08)                   | 18 (28.57)                |     |
| >4                      | 27 (4.23)                    | 11 (17.46)                |     |
| Desktop use             |                              |                           |     |
| No                      | 518 (78.84)                  | 56 (88.89)                | 0.058|
| Yes                     | 139 (21.16)                  | 7 (11.11)                 |     |
| Laptop use              |                              |                           |     |
| No                      | 521 (78.94)                  | 44 (69.54)                | 0.095|
| Yes                     | 139 (21.06)                  | 19 (30.16)                |     |
| Tablet use              |                              |                           |     |
| No                      | 540 (82.19)                  | 54 (85.71)                | 0.482|
| Yes                     | 117 (17.81)                  | 9 (14.29)                 |     |
| Smartphone use          |                              |                           |     |
| No                      | 271 (41.00)                  | 14 (22.22)                | 0.004|
| Yes                     | 390 (59.00)                  | 49 (77.78)                |     |
| Login status            |                              |                           |     |
| Intermittent login      | 458 (73.99)                  | 33 (53.23)                | 0.001|
| Permanent logged in     | 161 (26.01)                  | 29 (46.77)                |     |
| Chatting                |                              |                           |     |
| No                      | 304 (45.99)                  | 20 (31.75)                | 0.030|
| Yes                     | 357 (54.01)                  | 43 (68.25)                |     |
| Online friendships      |                              |                           |     |
| No                      | 525 (79.43)                  | 34 (54.84)                | <0.0001|
| Yes                     | 136 (20.57)                  | 28 (45.16)                |     |
| Online relationships    |                              |                           |     |
| No                      | 620 (93.80)                  | 56 (88.89)                | 0.177|
| Yes                     | 41 (6.20)                    | 7 (11.11)                 |     |
| Online shopping         |                              |                           |     |
| No                      | 407 (61.57)                  | 28 (44.44)                | 0.008|
| Yes                     | 254 (38.43)                  | 35 (55.56)                |     |
| Online movies           |                              |                           |     |
| No                      | 454 (68.68)                  | 30 (47.62)                | 0.001|
| Yes                     | 207 (31.32)                  | 33 (52.38)                |     |
| Online news             |                              |                           |     |
| No                      | 536 (81.09)                  | 50 (80.96)                | 0.739|
| Yes                     | 125 (18.91)                  | 13 (19.04)                |     |
| Searching information online |                        |                           |     |
| No                      | 166 (25.11)                  | 23 (36.50)                | 0.049|
| Yes                     | 495 (74.89)                  | 40 (63.49)                |     |
| Online gaming           |                              |                           |     |
| No                      | 434 (65.65)                  | 34 (53.91)                | 0.064|
| Yes                     | 227 (34.35)                  | 29 (46.09)                |     |
| Instant messaging       |                              |                           |     |
| No                      | 537 (81.24)                  | 35 (55.56)                | <0.001|
| Yes                     | 124 (18.76)                  | 28 (44.44)                |     |
| Gender                  |                              |                           |     |
| Male                    | 365 (55.2)                   | 46 (73)                   | 0.007|
| Female                  | 296 (44.8)                   | 17 (27)                   |     |

CI: Confidence interval; OR: Odds ratio

Table 2: Internet addiction and internet use patterns - logistic regression

|                         | Internet addiction | Adjusted OR (95% CL) |
|-------------------------|--------------------|----------------------|
| Personal device         |                    |                      |
| No                      | 1.00 (reference)   |                      |
| Yes                     | 1.56 (0.60-4.11)   |                      |
| Duration of use (h)     |                    |                      |
| 0-2                     | 1.00 (reference)   |                      |
| 2-4                     | 1.04 (0.39-2.74)   |                      |
| >4                      | 2.04 (0.60-6.94)   |                      |
| Desktop use             |                    |                      |
| No                      | 1.00 (reference)   |                      |
| Yes                     | 0.72 (0.24-2.22)   |                      |
| Laptop use              |                    |                      |
| No                      | 1.00 (reference)   |                      |
| Yes                     | 1.91 (0.80-4.53)   |                      |
| Tablet use              |                    |                      |
| No                      | 1.00 (reference)   |                      |
| Yes                     | 0.74 (0.23-2.37)   |                      |
| Smartphone use          |                    |                      |
| No                      | 1.00 (reference)   |                      |
| Yes                     | 1.62 (0.63-4.21)   |                      |
| Login status            |                    |                      |
| Intermittent login      | 1.00 (reference)   |                      |
| Permanent logged in     | 1.80 (0.78-4.17)   |                      |
| Chatting                |                    |                      |
| No                      | 1.00 (reference)   |                      |
| Yes                     | 1.06 (0.43-2.62)   |                      |
| Online friendships      |                    |                      |
| No                      | 1.00 (reference)   |                      |
| Yes                     | 2.43 (1.03-5.78)   |                      |
| Online relationships    |                    |                      |
| No                      | 1.00 (reference)   |                      |
| Yes                     | 0.84 (0.25-2.87)   |                      |
| Online shopping         |                    |                      |
| No                      | 1.00 (reference)   |                      |
| Yes                     | 2.11 (0.86-5.19)   |                      |
| Online movies           |                    |                      |
| No                      | 1.00 (reference)   |                      |
| Yes                     | 2.25 (0.89-5.64)   |                      |
| Online news             |                    |                      |
| No                      | 1.00 (reference)   |                      |
| Yes                     | 0.43 (0.16-1.18)   |                      |
| Searching information online |                |                      |
| No                      | 1.00 (reference)   |                      |
| Yes                     | 0.20 (0.08-0.52)   |                      |
| Online gaming           |                    |                      |
| No                      | 1.00 (reference)   |                      |
| Yes                     | 1.27 (0.55-2.95)   |                      |
| Instant messaging       |                    |                      |
| No                      | 1.00 (reference)   |                      |
| Yes                     | 1.78 (0.63-5.01)   |                      |
| Gender                  |                    |                      |
| Male                    | 1.00 (reference)   |                      |
| Female                  | 0.99 (0.44-2.20)   |                      |
was found to be 8.7%. This finding is similar to the prevalence reported in recent Indian studies considering the same cutoff for IAT (7.7%–11.8%).[6,9] This raises concern to address IA as an important emerging mental health issue among adolescents.

Earlier studies from India recruited participants from 16 to 19 years age group.[6,9,10] A recent study by Grover et al. reported the time lag between first exposure to internet and developing IA as 6 years.[29] Compared to previous studies, we chose to conduct a study in a younger population as children are getting access to internet use at a very young age.

Within this subgroup, we found that the mean age of those having IA was less than study population mean age. At very young age, adolescents are vulnerable to develop IA because of their psychological characteristics, limited supervision, and getting into online friendships.[10]

Male gender, owning a personal device, hours of internet use per day, use of smartphones, permanent login status, use of internet for chatting, online friendships, shopping, watching movies, online gaming, searching information online and instant messaging were found to be significantly associated with IA at the univariate level. These associations are in agreement with similar findings from previous studies.[6,9,10] Males are more susceptible to IA as they are primarily using internet for entertainment purposes such as gaming and watching sexually explicit material as compared to females.[24]

Sites such as Facebook and Twitter have become important platforms for chatting and developing online friendships. A study by Hong et al. reports that depressive character and Facebook usage significantly predict Facebook addiction which is a subset of IA.[25]

Internet use for online friendships was found to be a significant predictor of IA. This is in keeping with the findings of previous studies.[10] A review by Kuss and Griffiths reports that extroverts use such sites to increase their social network and friendships and introverts engage more into online friendships to compensate for their real life deficits.[26]

Internet use for searching information is found to be protective against IA. A study conducted in Bengaluru by Krishnamurthy and Chetlapalli states that using internet less for coursework predicted IA.[10] Adolescents using internet for information seeking are using their time constructively as compared to those using it for entertainment and social networking purposes. Engaging into more constructive work is shielding them from getting addicted.

Inappropriate internet use may lead to various legal problems such as being arrested for posting hateful posts on Facebook, Twitter, cyber-bullying, deaths while taking selfies, illegal online gambling, cyber-stalking, committing technological crimes, posting threats online, and being recruited by extremist agencies.[27,28]

This was a cross-sectional study which limits the interpretation to factors associated with IA. To further explore the risk factors contributing to IA, longitudinal studies need to be planned. There is a possibility of recall bias in the current study as the information was collected using self-reported questionnaires. A convenient sampling was used which limits the generalizability of these results.

**Conclusion**

With the rapidly increasing internet use among adolescents, IA is soon likely to emerge as a global health issue. Any adolescent presenting to primary care physician with behavioral issues and poor academic performance with a history of internet use needs to be screened for IA. Early interventions may include counseling regarding monitoring of internet use either by self or involving family members, encouraging face-to-face socialization, ensuring an adequate amount of sleep, exercise, and a balanced diet.[29]

Guidelines for interventions need to be developed to address IA among adolescents at the primary health-care level. Characteristics of internet usage found to be associated with IA needs to be considered while developing strategies for interventions. There need to be guidelines regarding what should be the age for exposure for internet, at what age a personal device for internet use should be provided to children, and permissible hours of internet use. Monitoring of hours and purpose of internet usage by parents and school authorities may help in controlled internet use. Policymakers may think of including “Responsible Internet Use” in curriculum keeping in mind the major public health issue IA is turning out to be.

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