

SUMMARY

Background: During the lockdown due to COVID-19, Internet use may become more frequent in students, with possible negative consequences on mental health. In this emergency situation, variables such as depression, anxiety and external locus of control could be related to a Problematic Internet Use; on the other hand, self-esteem, internal locus of control, self-efficacy, and social support can play the role of protective factors for Problematic Internet Use. The present survey aims to verify the impact of these intrapersonal and social factors on Problematic Internet Use in college and High School students during the COVID-19 pandemic through a web-based cross-sectional study.

Subjects and methods: 191 students from Lombardy, one of the Italian Regions among the most affected by the COVID-19 pandemic, were included in the study. An online questionnaire has been administered during the first Italian period of forced lockdown. A logistic regression analysis was performed to assess intrapersonal and social factors as predictors of Problematic Internet Use.

Results: Analysis highlighted a higher risk of Problematic Internet Use (5.77 times more) in males compared to females. Individuals with high external locus of control and severe depression have respectively 6.56 and 2.84 times more the risk of presenting Problematic Internet Use. In contrast, social support, self-efficacy, and self-esteem were negatively related to Problematic Internet Use. In total sample, the percentage of Problematic Internet Use was high (55.5%).

Conclusions: An increasing use of the Internet has been observed during lockdown, leading to a progressive increase in the diffusion of Problematic Internet Use. Gender, depression and external locus of control emerge as risk factors for Problematic Internet Use, while social support, self-efficacy and self-esteem represent protective factors. The current research identifies some intrapersonal and social factors in an epidemic context for which the development of effective behavioural, supportive and/or educational interventions would be appropriate.

INTRODUCTION

In December 2019, the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) broke out in Wuhan (Lu et al. 2020, Ren & Guo 2020). SARS-CoV-2 (often referred to as COVID-19) was declared on 11 March 2020 as a pandemic by the World Health Organization (WHO) (Driggin et al. 2020, Shuja et al. 2020).

In Italy, on 31 January 2020 the Italian Government declared a state of emergency. On 9 March 2020 a new decree-law was signed, introducing new measures for the containment of COVID-19. The physical isolation, along with the fear of infection, economic instability and stress due to the uncertainty of the future has had a strong impact on global mental health (Brooks et al. 2020).

Adolescents may experience similar stressors of adults during the pandemic (Wang et al. 2020, Joseph et al. 2020). This stress may be increased by the desire for autonomy and peer relationships (Brown & Larson 2009), both prevented by the warning to stay home (Ellis et al. 2020).

Internet use may represent both a protective and risk factor during the outbreak. As a protective factor, the possibility to communicate with one's family and friends is essential (Brooks et al. 2020). At the same time, the overuse of the Internet to obtain information about the outbreak may increase levels of anxiety and depression (Priego-Parra et al. 2020). Moreover, in people who present a problematic use of the Internet, lockdown could emphasize its antidepressant and anxiolytic function, thus reinforcing a vicious circle (depression/anxiety- internet use and disconnection- depression/anxiety- reconnection in order to improve mood and relieve anxiety; as in Romano et al. 2013), whereby Internet use may become more frequent with further impairment of daily functioning (Siste et al. 2020). Problematic Internet Use (PIU) is a multifaceted problem (Ioannidis et al. 2018). Researchers showed a similarity between PIU and addictive behaviors (Chen et al. 2015, Stavropoulos et al. 2017). Internet addiction is constituted by excessive preoccupations, craving and behaviors related to Internet access that cause impairment or distress (Shaw & Black 2008).

Adolescents (12-17 years) and emerging adults (18-29 years) (Pew Research Center 2012) are more vulnerable to Internet addiction (Yen et al. 2009). In relation to gender, findings across different cultural samples showed conflicting results. Numerous studies have shown that males are significantly more addicted to the Internet than women (Anand et al. 2018, Anderson et al. 2017, Chen et al. 2015), while other researchers have found opposite results (Sechi et al. 2020, Sun et al. 2012, Tran et al. 2017). These contrasting results are likely influenced by social and cultural differences (Błachnio et al. 2019a).

The epidemiology of PIU shows a range of prevalence estimates varying between 2% to 8% in the general population, ranging up to 20% in younger samples (Kuss et al. 2013). In Italy it is estimated that 0.8% of young individuals are seriously addicted and 5% moderately addicted (Poli & Agrimi 2012). Di Nicola et al. (2017) reported a prevalence of PIU of 22.1% in Italian High School students. Epidemiological data tend to be influenced by technology development and economic and cultural features of society, as well as by the healthcare conditions: for instance, in Taiwan the prevalence of Internet addiction was found to be 24.4% during COVID-19 outbreak (Lin, 2020). Individuals with Internet addiction show a range of comorbid symptoms (Guangheng et al. 2011) such as depression (Gundogar et al. 2012, Young & Rodgers 1998), anxiety disorders (Liu et al. 2011, Romano et al. 2014), sleep problems (Alimoradi et al. 2019, Liu et al. 2020). A possible compromise of immunity status and alterations of physiological responses were reported as well (Reed et al. 2015a, Reed et al. 2017, Romano et al. 2017). Several studies highlighted the role of different personality traits (Reed et al. 2015b, Truzoli et al. 2016, Hidayat & Nurhayati 2019; Reed et al. 2018).

Some studies analysed the impact on mental health of bereavement or having had contacts with COVID-19 positive people. Mazza et al. (2020) report that people with a family member infected presented higher levels of anxiety; moreover, having an acquaintance infected was associated with increased levels of both depression and stress. Other investigations were carried out during lockdown in the general population (Moccia et al. 2020, Rossi et al. 2020, Šljivo et al. 2020,

Lazzari et al. 2020, Sinanović et al. 2020) and in specific subgroups such health workers (Rapisarda et al. 2020, Salopek-Žiha et al. 2020) and found evidence of the negative impact of the pandemic on substance abuse, mood, sleep-wake profile, anxiety and other psychological variables.

Recent research highlighted an increase of anxiety and depression among students during the pandemic: Son et al. (2020) found that major contributors to depressive thoughts during the COVID-19 pandemic were loneliness and insecurity or uncertainty. An increase in depression as the pandemic was progressing was reported as well (Debowska et al. 2020). Authors argued that since students had to isolate to avoid infection, their desire for social connectedness was not met, determining a subsequent decrease of mood.

If on one hand, in critical environmental situations characterized by uncertainty and unpredictability, psychopathological variables such as depression and anxiety can make it more difficult to cope with environmental demands (Duan et al. 2020), on the other hand self-esteem (SE), locus of control (LoC), generalized self-efficacy (GSE), and social support (SS) can play the role of protective factors for PIU.

GSE represents people's beliefs about their capabilities to "organize and execute courses of action required to attain designated types of performances" (Bandura 1986, p. 391). Findings showed that Internet addiction negatively correlates with GSE (Wang et al. 2020), and with LoC (İskender & Akin 2010, Parkay et al. 2010).

Rotter (1966) distinguished between internal and external LoC. A person's ability and effort are regarded as internal causes of success or failure, whereas chance, fate, powerful others and luck are regarded as external causes. LOC was reported as a predictor of Internet Addiction (Chak & Leung 2004). Moreover, adolescents with internal LoC have 35% less probability to develop Internet Addiction than those with external LoC (Agaj 2016).

SE is defined as a favorable or unfavorable attitude toward the self, guided by personal opinions and beliefs (Baranik et al. 2008). SE levels influence internet use (March & Steele 2020) and evidence showed that SE is significantly negatively correlated with Internet addiction (Aydm & San

2011, Błachnio et al. 2019b, Yücens & Üzer 2018).

SS is defined as a person's subjective feelings and evaluations about being supported by other people in the external environment (Zimet et al. 1988). Studies show that SS and Internet addiction are negatively correlated (Lei et al. 2018). Some results indicated that IA severity was significantly and negatively predicted by offline SS, and mediated through SE (Lin et al. 2018).

Thus, the factors discussed (SE, LoC, GSE, and SS) emerge as interrelated and can contribute to a greater resilience in front of situations, such as the ongoing pandemic.

In Italy, some investigation on physical and mental health have been performed (Marelli et al. 2021, Meda et al. 2021), yet research on protective and risk factors of PIU in students during lockdown are still lacking.

In analysing the particular addiction represented by Internet addiction, this study refers to the theory of triadic influence (TTI) (Petraitis et al. 1995) in relation to psychosocial factors for Internet addiction in young people during the COVID-19 outbreak (Lin et al. 2018b).

The TTI applies to health behavior and categorizes protective and risk factors into three domains of influence (cultural/attitudinal, social/interpersonal, and intrapersonal). The aim of this study is not to examine a theoretical model, rather to systematically analyse some elements of the multiple etiological nature of Internet addiction. With reference to the quarantines of the COVID-19 pandemic, this study focused on the intrapersonal and social domains of influence. In our study, intrapersonal factors include depression, anxiety, locus of control, self-esteem, self-efficacy, and social factors include social support.

In light of what has been discussed, this study aims to verify the impact of (independent) intrapersonal and social factors - listed above - on PIU in High School and college students during the COVID-19 pandemic by a web-based cross-sectional study. Moreover, we aim at estimating PIU prevalence, while investigating eventual variations for gender, age, and school, in order to identify possible explanatory variables of PIU.

Subjects and Methods

A total of 191 students from North Italy (Lombardy, province of Milan) were included in the study, with a prevalence of females (73.3% females, n=140; 26.7% males, n=51). The age range was 14-48 years, with a mean age of 19.3 ± 5.64 . Participants attended High School (73.8%, n=141) or Bachelor in the area of healthcare professions (26.2%, n=50).

We sent invitations to participate to our study through an email sent directly to High School and Bachelor course directors. School and Bachelor leaders agreed to involve their students. Then, the directors of the High Schools and Bachelors advertised the possibility of participating in the research with a notice on their sites in the section reserved for communications with students. The questionnaires were administered online during the first Italian period of forced lockdown. After a short introduction in which the participants were informed on the content of the questionnaires and the importance of completing each item, they were asked to fill in all the questionnaires.

The participants read and signed a document containing information on the aim of the research, data processing and informed consent for the processing of sensitive data, the participation in the survey, and the use of the data for research purposes. In the case of High School students (underage), the authorization to the informed consent was given by parents. In this study the participants anonymity is preserved. Finally, this study is conforms to the provisions of the Declaration of Helsinki in 1995 (as revised in Edinburgh 2000).

MEASUREMENTS

The questionnaire was composed by a socio-demographic section, 7 survey scales and a final section with questions on the personal situation related to COVID-19. Age, gender, school type, municipality and province of residence were recorded in the socio-demographic section. The following measures were used:

- *Rosenberg Self-Esteem Scale* (RSES; Rosenberg 1965), is a 10-item self-administered scale that measures global self-worth by measuring both positive and negative feelings about the

self. All items are answered using a 4-point Likert scale format ranging from strongly agree to strongly disagree. Scores below 15 indicate low self-esteem; between 15 and 25 are in the normal range; above 25 indicate high self-esteem. The scale demonstrated good internal consistency (Cronbach's alpha = .84). In this study, the Italian version developed by Prezza et al. (1994) was used.

- *Generalized Self-Efficacy Scale* (GSE; Schwarzer & Jerusalem 1995), is a 10-item self-administered scale used to assess an individual's belief in his personal ability to cope with new or difficult situations. It consists of 10 items (rating scale 1-4). There is no cut-off. Cronbach's α values range from 0.82 to 0.93 (Schwarzer 1993, Schwarzer & Jerusalem 1995). In this study, the Italian version of the scale was used, developed by Sibilgia et al. (1995).
- *Multidimensional Scale of Perceived Social Support* (MSPSS; Zimet et al. 1988), is a brief self-report measure of social support in which 12-item ratings were made on a 7-point Likert-type scale ranging from very strongly disagree (1) to very strongly agree. There is no cut-off. The 12-item was designed to measure the perceived adequacy of support from the following three sources: family, friends and significant others. Cronbach's α values ranged from .84 to .92 for the scale as a whole. The Italian version of the scale used in this study was developed by Busoni & Di Fabio (2008).
- *Beck Anxiety Inventory* (BAI; Beck et al. 1988) is a 21-items (rating scale 0-3) self-administered questionnaire assessing the symptoms of anxiety only minimally superimposed on those of a depressive nature. Ratings are for the past week. Items are summed to obtain total scores ranging from 0 to 63 (Beck & Steer 1993). A score between 0-9 is considered normal, between 10-18 indicates medium anxiety, between 19-29 it detects moderately high anxiety, and between 30-63 it is indicative of severe anxiety. The suggested clinical cut-off

is ≥ 16 . Internal consistency is adequate: Cronbach's $\alpha=0.92$, and test-retest reliability (1 week) = 0.75 (Beck et al., 1988). In the current study, the Italian version developed by Sica & Ghisi (2007) was used.

- *Locus of Control Behavior* (LCB; Craig et al. 1984) measures the locus of control of behaviour, precisely the generalized expectancies for internal versus external control of the behaviour. The self-administered questionnaire consists of 17 items (rating scales from 0 to 5); there is no cut-off; high scores at the scale indicate the presence of a higher external locus. In this study, the Italian version of the instrument was used, developed by Farma & Cortinovis (2000), whose reliability parameters are like those reported in the original work (Cronbach's $\alpha=0.79$).
- *Center for Epidemiologic Studies- Depression Scale* (CES-D; Radloff 1977) is a self-report scale consisting of 20 items (rating scale 0-3) that includes 6 subscales aimed at assessing some dimensions of depression: depressed mood, feelings of guilt and worthlessness, feelings of helplessness and despair, psychomotor retardation, loss of appetite, and sleep disorders (Balsamo & Saggino 2007). A score less than 15 indicates absence of depression; between 15-21 indicates mild to moderate depression; over 21, it detects possibility of major depression. The suggested clinical cut-off is ≥ 16 . Cronbach's α coefficients range from 0.85 to 0.90 (Radloff 1977).
- *Internet Addiction Test* (IAT; Young 1998) is a 20-item scale covering the degree to which use of the internet disrupts everyday life (work, sleep, relationships, etc.). Each item is scored on a 1-4 scale, and the overall score ranges from 20 to 100. Young (1998) has suggested that employing a cut-off score of 40 or more for the total score of the IAT represents some level of problematic internet usage (see also Hardie & Tee 2005, Romano et al. 2013, Widyanto & McMurrin 2004), while a score of 70 or more suggests an Internet

addiction. The internal reliability (Cronbach α) of the scale has been found to be between .90 (Widyanto & McMurrin 2004) and .93 (Young 1998). In an Italian college students sample (Faraci et al. 2013), α values were satisfactory for both the one-factor solution (.91), and the two-factor solution (.88 and .79).

Statistical analysis

Categorical data were reported as counts (and percentages). Continuous variables were expressed as medians and interquartile ranges, or means and standard deviations, as appropriate.

We considered the occurrence of PIU as the endpoint of interest. We performed a logistic regression analysis to assess some individual factors as predictors of PIU, dichotomized as ‘Absent’ ($IAT \leq 39$) or ‘Present’ ($IAT \geq 40$). The following factors were considered in the regression analysis as predictors: age, school, gender, locus of control of behavior, self-esteem, self-efficacy, social support, symptoms of anxiety or depression, have contracted the virus or have had a contact with a COVID-19 positive person, and have had a family member with COVID-19 or have lost a loved one for the disease. Initially, an univariate analysis was performed including all the above listed predictors as independent variables in univariate logistic regression models. Subsequently, only the variables significantly associated with PIU in univariate analysis were considered in multivariate analysis. Finally, a stepwise procedure was used to find the best multivariate predictive model. Before running regression models, we categorized all continuous variables. The following scores were categorized according to clinical cut-offs: RSES total score (<15 or >25 vs 15-25), BAI total score (Normal vs Mild+Moderate vs Severe) and CES-D total score (Normal vs Mild+Moderate vs Major). In absence of clinical cut-offs, LCB total score, GSE total score and MSPSS total score were categorized into tertiles. Odds ratios (OR) with their 95% confidence intervals (CI) were calculated. The discriminative ability of the fitted models was assessed using the c-statistic. P values lower than 5% (two sided) were considered statistically significant. All of the statistical analyses were performed using the statistical software SAS (release 9.4).

RESULTS

The COVID-19 related information about the potential exposure to the virus and any consequences of infection are provided in Table 1.

INSERT TAB 1

Description of the socio-demographics characteristics of the 191 participants and of the scales used is reported in Table 2.

INSERT TAB 2

As regards the IAT, the participants who exceeded the cut-off value of 40 were 106 (55.50%). Of this, only 4 individuals (2.09%) had a score higher than 69. Then we divided the whole sample in two groups (≤ 18 years, and ≥ 18 years), but no significant differences were found.

In the univariate analysis, gender, SE, LoC, GSE, SS, anxiety and depression showed a statistically significant association with PIU. At multivariate analysis, only gender, LoC and depression were independently associated with PIU (c-statistic 0.773, Table 3).

INSERT TABLE 3

In particular, considering multivariate analysis, males have 5.77 times more the risk of presenting PIU when compared to females. Moreover, individuals with high external LoC (>29) and moderate

external LoC have respectively 6.56 and 3.41 times more the risk of presenting PIU when compared to participants with internal LoC (≤ 20). Lastly, participants with severe and mild-moderate depression have respectively 2.84 and 2.25 times more the risk of presenting a PIU when compared to participants without mood disorder.

Discussion

Internet has become an essential instrument in daily life, but its problematic use results in a negative impact on mental health (Guessoum et al. 2020; Wang et al. 2020). COVID-19 pandemic and subsequent lockdown may increase the risk of an intensive and problematic use of the internet (Deslandes & Coutinho 2020).

In our study the mean data about IAT, showed the overcoming of the cut-off score, highlighting some criticism in the daily functioning. Particularly, more than 55% of the total sample exhibit PIU, showing a greater risk of Internet addiction. Among these, over 2% of the sample showed an associated significant daily life impaired functioning.

In the pre-pandemic period, literature data highlighted differences among adolescents from different countries (Kuss et al. 2014, Wang et al. 2016). In Italy it is estimated that 0.8% of young individuals are seriously addicted (Poli & Agrimi 2012), and Di Nicola et al. (2017) have reported a PIU rate of 22.1% in Italian High School students.

Lin (2020) has shown an Internet addiction prevalence of 24.4% in High School during COVID-19 outbreak. The author has however used the Chen Internet Addiction Scale (CIAS; Chen et al. 2003); consequently, this data cannot be directly compared with our results because of the different scale used. However, considering the Italian data in the pre COVID-19 period, our sample has a higher percentage of young individuals seriously addicted.

In multivariate analysis we found that male gender, high values of LCB score and high values of CES-D total score were associated with high risk of PIU. PIU does not change according to age.

The predictive ability of this multivariate model was good (c-statistic=0.773).

Consistently with some literature data (Tsitsika et al. 2014), we found that male participants have a higher risk of PIU compared to females. Males have shown higher interests in the rewards and emotional compensation offered by the web as previously found in literature (Andreou & Svoli 2013, Hawii 2012), and it is documented that males use the Internet more frequently for downloading, gaming and gambling (Chen et al. 2015, Yu & Shek 2013), while females use it more for social networking (Choi et al. 2014). For this reason, it might be assumed that the activities of males are more addictive, exposing them to higher risk of internet abuse.

The COVID-19 emergency showed Internet addiction is associated with depression and anxiety (Oosterhoff et al. 2020, Priego-Parra et al. 2020). In our study, anxiety and depression are found to be associated with PIU, but depression seems to be the most significant risk factor.

An external LoC is an additional risk factor for internet addiction (Agaj 2016). This personality characteristic might lead to discomfort and uncertainty, making people less accustomed to use positive coping strategies (Caplan & High, 2011). Furthermore, some studies have demonstrated that an internal LoC represents a protective factor, showing an increased sense of control over the environment (Agaj 2016, Chak & Leung 2004). Our study confirms that during lockdown external LoC is often associated with PIU, representing a major risk factor.

Our study presents the SS as a protective factor during the COVID-19 lockdown. In fact, this period of emergency has been characterized by a higher prevalence of depression and anxiety symptoms (Qi et al. 2020), which might be exacerbated by low levels of social support (Guntzville et al. 2020, Simons et al. 2020). For this reason, the support of family members or friends could help reduce anxiety and depression, and facilitating the maintenance of stable emotions (Qi et al. 2020).

In our study GSE is shown as a protective factor. This data is consistent with studies finding a negative correlation between GSE and Internet addiction (Wang et al. 2020). A high rate of GSE, and the belief that it's possible to achieve goals with planned actions, could be useful to pursue behaviors to the prevention of the spread of respiratory infection and to reduce uncertainty feelings and declining mood. This probably leads to a more moderate use of internet as an instrument to

avoid negative thoughts and emotions (dysfunctional coping). In fact, GSE had effects on COVID-19 preventive behavior (Lin et al. 2020).

Moreover, in our study SE is negatively related with Internet addiction; this result is consistent with literature data (Błachnio et al. 2019b). A good self-esteem and ability to recognize one's own value may act as a protecting shield (buffer) against the detrimental psychological effects of life-threats possible in pandemic situations, as suggested by the anxiety-buffer hypothesis (ABH; Greenberg et al. 1992, Rossi et al. 2020).

Finally, in contrast to other studies (Mazza et al. 2020), no correlation emerged in our research between the potential exposure to COVID-19 and any consequences of infection and PIU. This may be due to the fact that the participants who had direct or indirect contact or some negative consequences in the family were relatively few in comparison to the total.

CONCLUSIONS

During the lockdown due to the spread of the COVID-19, we observed a high percentage of PIU in students, which was higher than the Italian data in the pre-COVID-19 period. PIU is the same in the age group considered.

Furthermore, our study found that male gender, external locus of control and depression were risk factors for PIU, whereas self-efficacy, self-esteem and social support were protective factors. In light of the theory of triadic influence (TTI), the intrapersonal and social factors we investigated contribute to the determination of the level of PIU.

Assuming that intrapersonal and social factors are modifiable through intervention (Hagger et al. 2020, Karaşar & Canlı 2020), the current research identifies certain factors in an epidemic context for which the development of effective behavioural, supportive and/or educational interventions would be appropriate.

A continuous focus on intrapersonal and social factors should be maintained with the aim of promoting the development of individual life skills and mental health.

This research has some limitations. The study was based on a cross-sectional design, and thus we cannot determine with reasonable certainty a cause-effect relationship between the variables studied, for which studies with a different experimental design would be necessary.

Second, the sampling is not random and it is not representative of the general population; in addition, only students from Lombardy were recruited and this could limit the generalizability of study. In any case, the participants lived in a region among the most affected by the pandemic in social, economic and health terms.

Finally, all data was obtained through self-reports. Further studies should use multiple-method assessments in order to provide a more comprehensive understanding of PIU during pandemic.

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