



# Perceived Stress During the COVID-19 Pandemic Mediates the Association Between Self-quarantine Factors and Psychological Characteristics and Elevated Maladaptive Daydreaming

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## Abstract

Since the emergence of the COVID-19 pandemic, almost all countries have employed varying degrees of lockdown measures to limit the spread of the infection. Previous studies showed that individuals with maladaptive daydreaming (MD) are affected negatively by the lockdown. In this study, we explored a set of lockdown measures (e.g., self-quarantine) and personal factors (e.g., education, history of depression, and personality traits) that might potentially exacerbate MD experienced during the lockdown period. We also examined whether perceived stress acted as a mediator in the relationship between these factors and MD. During the first lockdown from April to June, we analyzed data provided by 1083 individuals from the USA, the UK, Italy, and Turkey. A path analysis revealed that perceived stress mediated the effects on MD of self-quarantine, previous episodes of depression, low education level, and introversion and emotional instability. Our study suggests a conceptual framework for the factors that intensify maladaptive daydreaming under the threats of the pandemic and forced home confinement, offering implications for interventions with vulnerable populations.

**Keywords** COVID-19 · Psychological stress · Maladaptive daydreaming · Path analysis

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## Psychological Effects of the COVID-19 Pandemic

The emergence of a new strain of a zoonotic agent in Wuhan province of China in December 2019 (the 2019 novel coronavirus, COVID-19) was declared a worldwide pandemic by the World Health Organization. Throughout 2020, the COVID-19 has continued to inflict global chaos, as the numbers of confirmed cases and related mortalities continued to rise. The disease manifests itself with fever, cough, malaise, and pneumonia symptoms that emerge after an incubation period. The 2-14-day incubation time of the Coronavirus is an important factor in contagion because new carriers of the virus may unknowingly spread the disease before symptoms can develop (Centers for Disease Control and Prevention, 2021). In an effort to reduce close contact among citizens, governments ordered the closure of public places causing the shutdown of the shopping and retail, hospitality, entertainment, recreation and sport, transportation, and educational systems. As disease rates soared, authorities implemented lockdowns to various degrees, with some governments enforcing total curfews. This enduring global health emergency, along with worldwide efforts to curb the spread of the virus, has not only presented exceptional challenges for the working lives and careers of millions of individuals (Sohrabi et al., 2020; Wang et al., 2020) but also led to unparalleled worldwide effects on human well-being.

Fear of falling sick or dying, feeling worried and helpless, and experiencing stigma have been among the emotional effects experienced during the COVID-19 pandemic (Schimmenti, Billieux, & Starcevic, 2020a). The emotional effects on individuals were further aggravated with the closure of schools and businesses, adding worries about endangered family members and economic survival (Van Bortel, 2016). Previous studies on the psychological effects of the SARS outbreak on non-infected people have revealed significant psychiatric problems associated with younger age and increased self-blame (Sim, 2010). This finding has gained further support in the current pandemic. For instance, Kowal et al. (2020) and Brooks et al. (2020) reported that young age and the severity of pandemic stressors were related to increased levels of perceived stress and serious psychological crises. Self-isolation and quarantine were specifically associated with elevated levels of anxiety, anger, and confusion (Brooks et al., 2020), depression, mood swings, irritability, insomnia, inattention, anger, and post-traumatic symptoms (Rubin & Wessely, 2020). A good illustration of the psychological impact of the pandemic was presented in a recent analysis based on self-report data collected from a large sample of Canadians during early pandemic. This study shows that, while at the time of this survey, the impact of pandemic was low (number of cases between 1000 and 2000, see <https://www.worldometers.info>), high-level anxiety was 4 times higher and high-level depression was 2 times higher as compared to pre-pandemic times (Mental Health Research Canada, 2020).

International public health emergencies require the development of strategies to mitigate the negative psychological effects on individuals (Wang et al., 2020). It is important to identify psych-social risk factors that may exacerbate psychopathology during such sustained public emergencies so that adjusted interventions can be implemented. Thus far, research has recognized a set of such factors. For example, among those who may be more severely affected by the pandemic are individuals with (1) low educational level (Megatsari et al., 2020, Li, 2020), (2) compromised social skills causing a further decrease in their social competence, (3) emotional regulation problems causing amplified anxiety responses (Preti et al., 2020), (4) a history of a psychiatric condition

(Wathelet et al., 2020), (5) previous exposure to depressive episodes (Holingue et al., 2020), and finally, (6) introversion and emotional instability personality traits, which elevate individuals' vulnerability to threat during the pandemic (Preti et al., 2020; Liu et al., 2020).

Accumulating evidence suggests that a major mental health outcome of the current pandemic is the worsening of addictive "self-medication" practices (Khantzian, 1997) such as the consumption of alcohol (Chodkiewicz et al., 2020), substance abuse (Rogers et al., 2020) and escapist behaviors such as online gambling (Price, 2020), excessive smartphone usage (Elhai et al., 2020), and online gaming (Balhara et al., 2020). The current study wishes to focus on the impact of stress associated with the current pandemic on a newly emerging clinical condition that can also be conceptualized in terms of an addictive mental behavior often functioning as self-medication, that is, maladaptive daydreaming (MD, Somer, 2002).

## Maladaptive Daydreaming During the Pandemic

Daydreaming and mind-wandering are prevalent normal mental activities that occupy almost half of all human thought, in hundreds of short daily fantasy episodes involving self-created thinking that diverge from the current activity (Klinger, 2009). This mental activity is likely to have evolutionary utilities as it may help survival via better future planning (Mooneyham & Schooler, 2013). In contrast, MD characterizes individuals who are absorbed daily in vivid daydreaming in a manner that causes clinically meaningful distress or diminishes performance in social, occupational, or other important areas of life (Somer, 2002). MD is associated with a strong yearning, it can be activated or maintained by evocative music, and is often accompanied by stereotypical physical movements such as pacing, swinging, or hand movements (Somer, 2002). Although maladaptive at a functional level, immersive daydreaming (West & Somer, 2020), the trait underlying MD, may confer individuals with stress tolerance (Pietkiewicz et al., 2018). In other words, it might be a form of autistic fantasy a person employs to avoid stress related to real-life problems (Schimmenti et al., 2019).

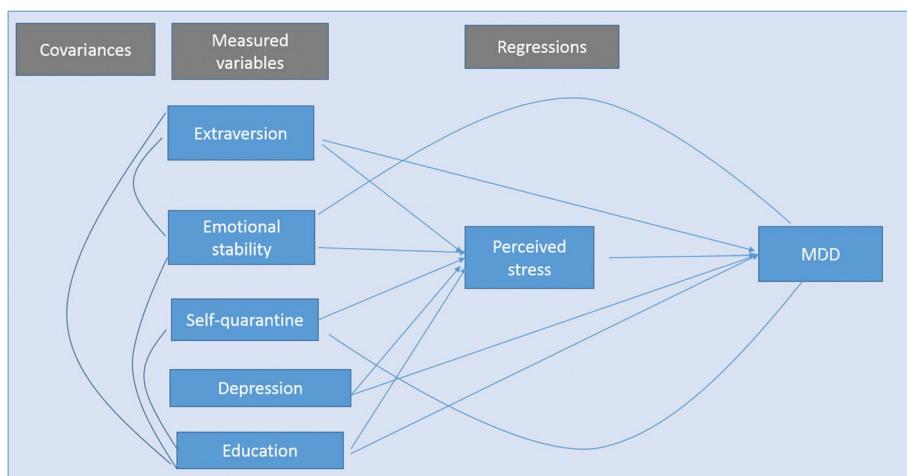
Previous studies on MD during the COVID-19 pandemic showed that individuals with MD experience an elevated daydreaming frequency and intensity (Somer et al., 2020), as well as heightened depression, anxiety, and reduced online social relationships (Musetti et al., 2021). In the current study, we aimed to explore under objective stress conditions and in real time the roles of lockdown factors, specific personal characteristics, and perceived stress in MD.

Extraversion is a personality trait characterized by friendliness, assertiveness, and high energy levels (Soto & John, 2017). The literature suggested that extraversion could moderate the relationship between the severity of imposed measures and psychopathology (Brooks & Moser, 2020; Steel et al., 2008). They argued that the change in lifestyle associated with the lockdown measures would feel more natural to introverts, who tend to avoid social engagement (Woodcock et al., 2013) and who could unashamedly prefer solitude over engagement with others. Support for this idea was provided by Wijngaards et al. (2020) who showed that although severe social distancing measures generally help extraverts who tend to feel safer and worry less, the ensuing restricted lifestyle felt more natural to introverts. However, since individuals with MD prefer privacy to engage in their abnormal mental activity, we suspected that introversion would be associated with elevated MD.

Because individuals with low levels of emotional stability are more likely to experience stress during lockdown (Liu et al., 2020), we also suspected that emotional instability will be related to stress perception. Besides, we expected that people with a propensity for depression would face greater stress levels during the lockdown as compared to individuals with lower levels of depression (Holingue et al., 2020). Based on previous studies, we also envisaged that the education level would inversely affect an individual's perceived stress level (Li, 2020; Megatsari et al., 2020). Thus, perceived stress acts as the principal mediator in our conceptual model (see Figure 1). Research suggests that education would covary with the employment of self-quarantine since individuals with a higher level of education are likely to follow quarantine rules more strictly. Furthermore, it is also known that individuals with higher education have higher emotional stability and extraversion (OECD Education at a glance report, 2012; Andersen et al., 2020). Therefore, the covariance between self-quarantine and education and that between education and personality traits are taken into account in our attempt to understand the relationships between lockdown factors, personal characteristics, perceived stress, and MD, as shown in Fig. 1.

## Perceived Stress

Stress-related and psychiatric disorders are, according to the World Health Organization (WHO), the second most common non-communicable health concern worldwide (Murray et al., 2012). The literature suggests that perceived stress correlated strongly with reported health complaints (Wiklund et al., 2012), more mental health symptoms, in general (Thorsen et al., 2016), and with elevated anxiety and depression, in particular (Bergdahl & Bergdahl, 2002). In the context of the current pandemic, perceived stress was associated with anxiety and depression in hospitalized patients with COVID-19 (Zandifar et al., 2020) and socially isolated people (Xu et al., 2020), demonstrating the potential role of subjective threat appraisal during this unprecedented crisis.



**Fig. 1** Conceptual model of relationships between lockdown factors, personal characteristics, perceived stress, and MD

## The Present Study

The current pandemic is a major cause of uncertainty, fear, and stigmatization requiring the execution of adequate mental health interventions tailored to the specific needs of susceptible populations (Schimmenti, Billieux, & Starcevic, 2020a) who may perceive risks differently. With this in mind, our suggested conceptual model (Figure 1) may refine our understanding of how clinical history and personal characteristics can explain the symptoms of maladaptive daydreaming during a stressful pandemic. Our first hypothesis is that self-quarantine, previous episodes of depression, lower education level, introversion, and emotional instability will be associated with elevated MD. Our second prediction is that perceived stress during the pandemic will mediate the possible impact of these risk factors on MD.

## Method

### Participants and Procedure

This study was approved by the University Human Research Ethics Committees of the first and second authors' universities. Data were collected online via Qualtrics during April and May 2020 as a part of a multicenter international study. Participants completed the survey at the height of the first pandemic wave, while most countries implemented strict lockdown restrictions. The sample comprised 1796 participants from various countries. After eliminating individuals with missing data, we focused our analyses on participants from countries with samples exceeding 100 respondents: the USA ( $n = 356$ ), Italy ( $n = 365$ ), Turkey ( $n = 268$ ), and the UK ( $n = 103$ ). Participants' educational level corresponded to an elementary/high school certificate, bachelor's degree, or graduate/post-graduate degree. Moreover, the participants reported their gender, age, whether they were required to self-quarantine/isolation (yes/no), and whether they had a diagnosed pre-existing depression assigned to them by a mental health professional (yes/no). In addition to providing information on these factors, the participants completed a set of cross-culturally validated measures on maladaptive daydreaming, perceived stress, and personality administered to them in their native language. Descriptive statistics of the study variables are displayed in Table 1.

**Table 1** Descriptive statistics of study variables

	Italy	Turkey	UK	USA
MD mean (SD)	45.04 (26.31)	39.03 (26.58)	62.71 (20.88)	56.60 (23.52)
Perceived stress mean (SD)	2.24 (0.76)	2.24 (0.71)	2.51 (0.71)	2.49 (0.72)
Extraversion mean (SD)	3.86 (1.55)	4.46 (1.75)	2.79 (1.45)	2.96 (1.77)
Emotional stability mean (SD)	3.52 (1.71)	9.1 (1.42)	3.18 (1.41)	3.34 (1.56)
Sex (% male)	29	19	12	13
% Major depression history	8	8	21	33
% Self-quarantine	32	41	52	46
% Education level (elementary/bachelor/graduate)	38/24/37	13/33/55	40/32/28	29/47/24

## Measures

The recruitment of research participants during an emergency and the prevention of their dropout have been recognized as serious challenges (Knack et al., 2006). The need to retain research respondents has generated a demand for efficient measures of psychological constructs in psychology. While shorter instruments might be more limited than longer ones, they have obvious benefits in reducing the burden. Furthermore, short versions of psychological measures often show similar reliability, factorial validity, and convergent/discriminant validity to longer versions (Kemper et al., 2019). There is also evidence that a measure containing even a single, global question is sometimes likely to suffice (Bowlling, 2005). To guarantee optimal participant adherence during the current emergency, we resorted to the shortest measures available for the assessment of the target variables.

**Maladaptive Daydreaming** We employed Somer (2018) 16-item Maladaptive Daydreaming Scale (MDS-16) to gauge the respondents' maladaptive daydreaming. A sample item is "Some people feel distressed or concerned about the amount of time they spend daydreaming. How distressed do you currently feel about the amount of time you spend daydreaming?". Respondents selected their responses on an 11-point Likert scale ranging from 0 to 100%, to indicate their daydreaming level. The scale does not contain reverse items and the total score is calculated as the mean score of 16 items. A high score on this scale shows a heightened MD level. The MDS-16 demonstrated excellent reliability in the present study (Cronbach's  $\alpha = .95$ ). Previous studies also demonstrated that the scale is reliable among Turkish, Italian, and English-speaking individuals ( $\alpha = .88, .95, .95$ , respectively; Metin et al., unpublished data, Somer et al., 2016; Schimmenti et al., 2020b).

**Personality Traits** We used the 10-item Big-5 personality questionnaire (Gosling et al., 2003). This is a 7-point Likert scale (from 1—disagree strongly to 7—agree strongly) that measures emotional stability, extraversion, agreeableness, conscientiousness, and openness to experience. For each dimension, there is a regular and a reverse item. The score for each dimension is the mean of those two item scores. A higher score indicates the presence of a particular trait to a greater extent. For this study, we used the four items measuring emotional stability and extraversion. Respondents were asked to rate the extent to which a pair of traits like "extraverted/enthusiastic" (defining extraversion) or "calm/emotionally stable" (defining emotional stability) applies to them. As justified by Gosling et al. (2003), previous studies show that the personality dimensions measured by this scale correlate sufficiently to longer versions of the Big-5 scales. In the present study, Cronbach's  $\alpha = .62$  for the emotional stability and .71 for extraversion traits.

**Perceived Stress** We used Cohen et al. (1983) 10-item perceived stress scale to quantify stress level. An example item of this 5-point Likert scale (from 0—never to 4—very often) is "In the last month, how often have you felt that you were unable to control the important things in your life?". The total score is calculated as the mean of individual items. Four items on this scale are reversed. A high score indicates increased stress perception. Cronbach's  $\alpha$  reliability of the scale was .87 in the current study.

## Data Analysis

All analyses were performed using SPSS v.24 and the Lavaan package in the R statistical software. To examine if the hypothesized model in Figure 1 showed an adequate fit, we used both absolute (e.g., RMSEA, SRMR) and incremental (e.g., CFI) fit indices. Generally accepted cutoff criteria for a good fit in these indices are as follows: RMSA  $\leq$  0.06, SRMR  $\leq$  0.08, and CFI and TLI  $\geq$  0.95 (Hu & Bentler, 1999).

## Results

### Preliminary Analyses

The national samples differed significantly in MD levels,  $F(3,1079) = 38.44$ ,  $p < .001$ . As shown in Table 1, British participants had greater MD scores than respondents from other countries, and Turkish participants had the lowest MD scores. Participants from the UK and the USA reported greater perceived stress compared to their Turkish counterparts. However, since we measured relationships between variables rather than comparing samples, this national differentiation was inconsequential. As shown in Table 2, individuals were more likely to suffer from MD during the lockdown if they reported a past diagnosis of major depression. Furthermore, the less educated, more introverted, emotionally unstable the individuals were, the more severe their MD.

### Mediation Analyses

The analyses evaluated the model in the combined international sample. Model fit statistics suggested a good fit. The results of Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) indices were within the acceptable limits of good model fit to the data ( $\chi^2_{(3)} = 7.5$ ,  $p = .06$ ; CFI = .996; TLI = .971; RMSEA = .039 [90% C.I. = 0.0–0.08], SRMR = .021). The regression estimates (see Figure 2) showed that a past diagnosis of major depression, the employment of self-quarantine, a lower level of education, introversion, and emotional instability were associated significantly with the respondents' perceived stress. Similarly, a past diagnosis of major depression, the employment of self-quarantine, a lower level of education, introversion and emotional instability, and perceived stress were all associated significantly with MD. Our indirect effect analyses indicated that

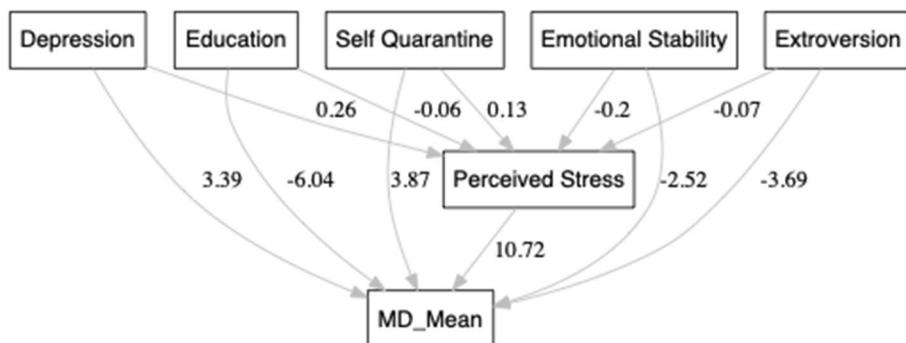
**Table 2** Pearson's  $r$  correlations between study variables

	Extroversion	Emotional stability	Perceived stress	Education <sup>a</sup>	Depression <sup>b</sup>
MD	-.43*	-.40*	.51*	-.33*	.23*
Extroversion		.20	-.29*	.23	-.16*
Emotional stability			-.50*	.14*	-.16*

\* $P < .001$

<sup>a</sup>Education = 1 (elementary/high school), 2 = bachelor degree, 3 = graduate degree

<sup>b</sup>Depression = 0 (yes), 1 (no)



**Fig. 2** Regression estimates of the employment of self-quarantine, lower level of education, introversion, and emotional instability

perceived stress mediated the associations between all measured independent variables and MD, as shown in Table 3.

## Discussion

As expected, self-quarantine and a past diagnosis of depression were associated with MD, confirming previous research showing that individuals with probable MD who were subject to lockdown restrictions and those with pre-existing mental health conditions reported had spent more time in intense fantasy (Somer et al., 2020). Many of our respondents who reported high MD levels spontaneously wrote to inform us how the home confinement disrupted their routines and generated boredom, loneliness, and sadness. The uncontrollability of the situation and stimulus deprivation motivated many to regulate their distress by resorting to their mental addiction for the relief of stress associated with the adversities.

Our data shed further light on personal characteristics associated with MD, suggesting that introversion and emotional instability are related to MD. Individuals with MD often experience difficulties managing problematic emotions and use their daydreaming as a fleeting escape (Bigelsen & Schupak, 2011). Our results imply that the compensatory themes in MD fantasy might be particularly appealing to persons who are uncomfortable with real social interactions. Our data are in line with data showing that social anxiety is a risk factor for MD (Somer & Herscu, 2017). Our findings are also in line with previously published data showing that MD is not an effective emotional regulation strategy (West & Somer, 2020).

**Table 3** Mediation model:  
indirect effects

Indirect effect	Estimate	Std. error	Z value	P
Past major depression	2.77	0.62	4.45	<.001
Education	-0.62	0.27	-2.26	.02
Self-quarantine	1.38	0.44	3.11	.002
Extraversion	-0.72	0.14	-5.09	<.001
Emotional stability	-2.13	0.25	-8.53	<.001

We also found that during the lockdown, there was an inverse relationship between the level of education and MD severity. The association between education and mental health has been documented before (Niemeyer et al., 2019). It seems that individuals with low education had fewer psychological resources to cope with adversities and were, therefore, more likely to resort to ineffective forms of emotion regulation, such as MD.

Finally, we found that perceived stress was strongly related to MD. The pandemic and the lockdown stressors can be seen as a set of demands that individuals had perceived as exceeding their abilities and resources (Lazarus, 1991) and, thus, lead to negative outcomes, such as MD. Cognitive appraisals were previously shown to mediate the relationship between stress and psychological health (Gomes et al., 2016). Our findings indicate that perceived stress is an important underlying mechanism in explaining worsened MD in the shadow of the pandemic threat. Our data also imply that MD could be an unsuccessful attempt at stress regulation since self-quarantine seems to be associated with higher MD via an elevated subjective stress appraisal. In line with our previous report (Somer et al., 2020), the current data demonstrate that exacerbated MD can be a mental health consequence of the stressful effects of the lockdown. Several hypotheses concerning the general relationship between stress and MD have been suggested: Pietkiewicz et al. (2018) argued that MD is a type of behavioral addiction, initially developed as a mechanism for coping with stress. According to this hypothesis, immersion in vivid mental scenarios serves as a distraction from stressful circumstances and can relieve emotional tension. Although this hypothesis brings a plausible explanation to the association of stress and MD, from another point of view, a coping strategy may not be deemed as a behavioral addiction (Kardefelt-Winther et al., 2017). Based on these two views, we argue instead that immersive daydreaming (West & Somer, 2020) might serve as an effective coping for some people but on the other end of the dimension, uncontrolled immersive daydreaming (MD) is associated with spending hours every day in fantasy which may be deemed addiction for others. It should also be noted that, according to Khantzian and Treace (1985), an addiction is facilitated when the addictive substance or behavior has self-medicating properties. So, MD might be first employed as self-medication to relieve uncomfortable sensations associated with stress, but it might later transform into a form of behavioral addiction that is independent of the stressful events.

In sum, individuals with lower education, previous depressive episodes, and specific traits such as introversion and emotional instability who experienced the pandemic and the ensuing social restrictions as stressful might require closer clinical monitoring. These results confirm our first research hypothesis and indicate that lockdown-related hardships may affect individuals with different personalities in different ways and degrees. This outcome might be important for tailoring the interventions during the current pandemic and other mass emergencies.

In line with our theoretical expectation and the second hypothesis, perceived stress emerged as an important mediator of the possible effects of psychological variables and self-quarantine on MD. The transactional model of stress (Folkman & Lazarus, 1984) identifies two forms of cognitive appraisal that account for the experience of stress in response to an event: “primary appraisal” and “secondary appraisal”. During the primary appraisal, an event is interpreted as a threat to the individual. During the secondary appraisal, the individual evaluates their ability or resources to be able to cope with a specific situation as inadequate. Our mediation model implies that under the objective circumstances of the pandemic, MD will worsen among at-risk individuals who tend to appraise the conditions as exceeding their ability to cope.

At times of mass disasters and multi-casualty events, medical and mental health resources are prone to achieve insufficiency, often requiring the utilization of triage principles. Our data suggest that help efforts during mass casualty situations should focus on reaching out to the less educated and those with psychological vulnerabilities. However, our mediation model also shows that a promising intervention to moderate deteriorating psychiatric conditions such as MD is the instilling of cognitive reappraisal skills that can buffer the direct association between objective and personal risk factors and MD.

A couple of study caveats should be noted. First, our findings are based on a sizable international sample, and the sample was neither random nor representative; thus, generalizability is limited. Second, the mediator and all other variables were simultaneously assessed at a single time point in a cross-sectional design. A longitudinal research strategy could have allowed stronger conclusions regarding the role of perceived stress in our conceptual model. In conclusion, people prone to develop heightened MD symptoms during times of crisis may benefit from clinical interventions designed to improve behavior and emotion regulation, as these can help improve emotional stability and reduce perceived stress. Furthermore, providing skills to facilitate communication with others and to promote socialization via the available instruments (e.g., the Internet) might help these individuals, as more extraverted behaviors could protect them from an excessive escape into the fantasy world.

## Declarations

**Conflict of Interest** The authors declare no competing interests.

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