The relationship between burden caused by coronavirus (Covid-19), addictive social media use, sense of control and anxiety

J. Brailovskaia [*], J. Margraf

Mental Health Research and Treatment Center, Department of Clinical Psychology and Psychotherapy, Ruhr-Universität Bochum, Bochum, Germany

A B S T R A C T

The outbreak of Covid-19 has significantly restricted people's everyday life and contributed to enhanced social media use (SMU). The present study investigated the relationship of burden caused by Covid-19 and addictive SMU. Data were assessed in a sample of 550 users of social media (age: M (SD) = 27.08 (6.74)) from Germany via online surveys in spring 2020. In a moderated mediation analysis, the positive association between burden and addictive SMU was significantly mediated by the level of perceived sense of control. Anxiety symptoms significantly moderated the relationship between sense of control and addictive SMU. Specifically, the link between both variables was significant only for medium and high levels of anxiety symptoms. The present findings disclose the mechanisms that can contribute to the development of addictive tendencies during the pandemic outbreak. Potential practical implications and ways of how the negative consequences of burden caused by Covid-19 might be prevented are discussed.

1. Introduction

Sense of control is an important element of human being. People try to control most facets of their life and the events around them (Skaff, 2007). Loss of control often evokes emotional discomfort and a strong wish to regain control (Seligman, 1972). Longer periods of low sense of control in important areas of one's life can foster symptoms of anxiety and contribute to maladaptive coping strategies such as problematic alcohol use (Keeton, Perry-Jenkins, & Sayer, 2008; Volpicelli, 1987).

In the 21st century, individuals who experience different areas of life as uncontrollable and have enhanced levels of anxiety symptoms tend to excessively engage in social media use (SMU) (Apaolaza, Hartmann, D'Souza, & Gilsanz, 2019; Atroszko et al., 2018; Brailovskaia, Schillack, & Margraf, 2020; Primack et al., 2017; Ryan, Chester, Reece, & Xenos, 2014). On social platforms such as Facebook, they can at least temporarily escape negative emotions (Marino, Gini, Vieno, & Spada, 2018). Here, they themselves decide which image of their own person to create, which site to visit and with whom to interact (Boyd & Ellison, 2007). This evokes the impression to gain back some control over their life lost in the real world (Ryan et al., 2014).

However, positive online experiences can contribute to the development of a close emotional bond to social media (SM) and a strong need to stay permanently online (Brailovskaia, Schillack, & Margraf, 2020).

This phenomenon has been termed as addictive SMU and is defined by six typical characteristics (Andreassen, Pallesen, & Griffiths, 2017): salience (i.e., permanent thinking about SMU), tolerance (i.e., more and more time has to be spent on SM to experience positive emotions), mood modification (i.e., mood improvement by SMU), relapse (i.e., reverting to higher amounts of SMU after unsuccessful attempts to reduce the online activity), withdrawal symptoms (i.e., feeling unconformable and nervous without SMU), and conflicts (i.e., interpersonal problems caused by SMU) (Andreassen et al., 2017; Griffiths, 2005). Individuals with enhanced levels of addictive SMU often lose control over their online behavior and experience intensive uneasiness when they must temporarily leave the SM (Bányai et al., 2017).

Addictive SMU is currently not recognized as an official psychiatric diagnosis. But more and more research from various countries describes its increase and its potential negative consequences that should not be ignored (e.g., Kaye, 2019; Marino et al., 2018). For instance, addictive SMU (specifically addictive use of Facebook) was reported to be positively related to the experience of stress symptoms in a sample of young university students (Apaolaza et al., 2019). Furthermore, in a longitudinal study, addictive SMU positively predicted the level of depression and insomnia up to six weeks later in a sample of clinical patients mostly diagnosed with affective disorders (Brailovskaia, Rohmann, Bierhoff, Margraf, & Köllner, 2019). Moreover, it positively predicted suicide

ideation and behavior up to one year later in a sample of mostly young university students (Brailovskaia, Teismann, & Margraf, 2020). Thus, based on the described findings, it can be concluded that the attempt to compensate loss of control in real life by increasing sense of control on SM can contribute to further control loss and negative consequences for mental health.

The outbreak of the coronavirus disease in December 2019 (Covid-19; severe acute respiratory syndrome coronavirus 2, SARS-CoV-2) and its rapid spread have significantly changed people's everyday life (World Health Organization, 2020). Due to the lack of vaccine and effective medication, many governments and authorities introduced restrictive measures to reduce physical contact among the population (Sohrabi et al., 2020). The measures varied between countries and regions, but mainly included bans on gatherings, cancelling of mass events and closing of public institutions, non-essential shops and businesses. In some countries, a "stay-at-home" was ordered. Leaving home was allowed only in urgent cases. Wearing face masks and maintaining distance to other people is still mandatory in many countries (Gandhi & Rutherford, 2020; Tso & Cowling, 2020).

The urgent measures to reduce the pandemic spread changed the everyday life of many individuals, especially of those who previously were used to traveling and meeting people at work and in leisure. Many people perceive the current Covid-19 situation as a heavy burden (Brailovskaia & Margraf, 2020). They experience control loss over their daily activities and lifestyle accompanied by anxiety symptoms (Taylor et al., 2020; Xiong et al., 2020). Due to the exceptional nature of the Covid-19 situation and the uncertainty about its future course and duration, the anxiety symptoms can refer to different factors (Galea, Merchant, & Lurie, 2020; Liu, Zhang, Wong, & Hyun, 2020; Usher, Durkin, & Bhullar, 2020). For instance, the anxiety symptoms can be related directly to the virus (e.g., anxiety about the risk of being infected), and/or they can be associated with potential future consequences of the current Covid-19 situation (e.g., economic and health-system collapse, unemployment, interpersonal problems) (Paredes, Apaolaza, Fernandez-Robin, Hartmann, & Yañez-Martinez, 2020; Roy et al., 2020).

Considering earlier findings on problematic SMU (e.g., Atroszko, et al., 2018; Brailovskaia, Schillack, & Margraf, 2020; Ryan et al., 2014), it can be assumed that some people engage in intensive SMU to substitute the reduced sense of control in the real world and to escape the feelings of anxiety caused by the current Covid-19 situation. In accordance with this assumption, recent research reported an increase of SMU since the pandemic outbreak (Gao et al., 2020). In the short-term, SMU can reduce the feelings of loneliness and isolation and foster the experience of social support (Indian & Grieve, 2014). However, in the longer-term, it can contribute to the development of addictive tendencies and negatively impact mental health (Andreassen et al., 2017; Brailovskaia, Teismann, & Margraf, 2020; Twenge, Joiner, Rogers, & Martin, 2018).

It is unclear for how long the pandemic will spread around the globe. Considering the presented background, it is urgent to investigate potential negative consequences of the burden caused by Covid-19, to identify people at risk and to understand how their mental health can be protected in the current extraordinary situation. Therefore, the main aim of the present study was to investigate the relationship between the burden caused by Covid-19 and addictive SMU. Previous research described that burden caused by stressful experiences can reduce the individual sense of control, and reduced sense of control can contribute to the decrease of mental health (Skaff, 2007). Based on this framework, following hypotheses are formulated. Burden caused by Covid-19 is assumed to be positively associated with addictive SMU (Hypothesis 1a). Sense of control is expected to be negatively related to burden (Hypothesis 1b) and to addictive SMU (Hypothesis 1c). Moreover, sense of control is expected to mediate the association between burden and addictive SMU (Hypothesis 1d). Furthermore, individuals with low sense of control often experience high levels of anxiety symptoms (Keeton et al., 2008). Anxiety symptoms are described to be an

important predictor of addictive SMU (Atroszko et al., 2018). Therefore, it is assumed that anxiety symptoms are negatively linked to sense of control (Hypothesis 2a). Their relationship with addictive SMU is expected to be positive (Hypothesis 2b). Moreover, it is hypothesized that anxiety symptoms moderate the association between sense of control and addictive SMU (Hypothesis 2c). Specifically, the higher the anxiety symptoms, the closer the link between low sense of control and high addictive SMU. Fig. 1 illustrates the hypothesized relationships as a moderated mediation model (cf., Hayes, 2013, p. 450).

2. Materials and methods

2.1. Procedure and participants

The sample comprised of 550 participants from Germany (76.2% women; M_{age} (SD_{age}) = 27.08 (6.74), range: 18–71; occupation: 33.5% employed, 65.3% students, 1.1% unemployed, one retired person; marital status: 42.5% single, 44.9% in a romantic relationship, 12.5% married). One person had been tested positive for Covid-19, and 4.7% of the participants had family members or close friends who had been tested positive; 10% reported to belong to a Covid-19 risk group (i.e., age-related, pre-existing condition, weakened immune system). Data were collected between March and May 2020. A participation invitation including a link leading to the online survey was emailed to a randomly collected group of 600 persons. They all were current or former students of a large university in the Ruhr region and had previously agreed to be contacted for research investigations. The only requirement for participation was a current membership on a social platform. The participation was voluntary and compensated by course credits for students. All participants were provided instruction and gave informed consent to participate via an online form. The study implementation was approved by the responsible Ethical Committee. There were no missing data. No data were excluded. Power analyses using the G*Power program, version 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009) indicated that the sample size is sufficient for valid results (power > .80, α = 0.05, effect size: f^2 = 0.15; cf., Mayr, Erdfelder, Buchner, & Faul, 2007).

2.2. Measures

Burden caused by Covid-19. Following Brailovskaia & Margraf, (2020) the experience of burden caused by Covid-19 was assessed with six items (e.g., "I am burdened by the current social situation", "I feel restricted in my everyday life", "I feel socially isolated"). Items are rated on a 7-point Likert-type scale (1 = *I do not agree*, 7 = *I totally agree*; current scale reliability: Cronbach's α = 0.749). Higher sum scores indicate higher burden.

Sense of Control. Following Niemeyer, Bieda, Michalak, Schneider, and Margraf (2019) sense of control was measured with the two items "Do you experience important areas of your life (i.e., work, free-time, family, etc.) to be uncontrollable, meaning that you cannot, or barely
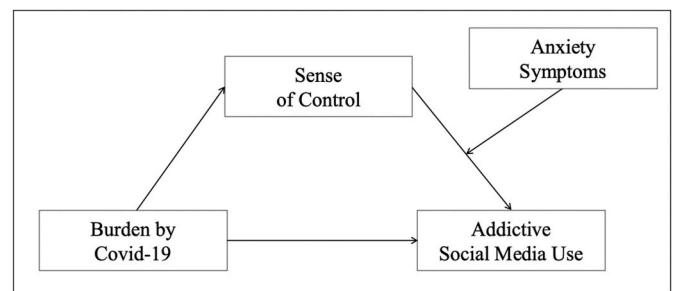

Fig. 1. Moderated median model with burden caused by Covid-19 (predictor), sense of control (mediator), anxiety symptoms (moderator) and addictive social media use (outcome).

can, influence them?" and "Do you experience these important areas of your life as unpredictable or inscrutable?". Items are rated on a 5-point Likert-type scale (0 = *not at all*, 4 = *very strong*; current scale reliability: $\alpha = 0.810$). Higher sum scores indicate lower sense of control.

Anxiety Symptoms. Anxiety symptoms can refer to different factors, specifically in the extraordinary Covid-19 situation (Liu et al., 2020). Therefore, to gain a broader picture of the current situation, the general level of anxiety symptoms was assessed. The anxiety subscale of the Depression Anxiety Stress Scales 21 (DASS-21; Lovibond & Lovibond, 1995) measured general anxiety symptoms over the past week with seven items (e.g., "I felt scared without any good reason"). Items are rated on a 4-point Likert-type scale (0 = *did not apply to me at all*, 3 = *applies to me very much or most of the time*; current scale reliability: $\alpha = 0.783$). The higher the sum score, the higher the anxiety symptoms.

Addictive Social Media Use. The level of addictive SMU was assessed with the brief version of the Bergen Social Media Addiction Scale (BSMAS; Andreassen et al., 2017). This instrument consists of six items (e.g., "Felt an urge to use social media more and more?") according to the six core addiction features (i.e., salience, tolerance, mood modification, relapse, withdrawal, conflict). Items are rated on a 5-point Likert-type scale (1 = *very rarely*, 5 = *very often*; current scale reliability: $\alpha = 0.810$). Higher sum scores indicate higher addictive SMU.

2.3. Statistical analyses

Statistical analyses were conducted using SPSS 26 and the macro Process version 3.5 (www.processmacro.org/index.html; Hayes, 2013). After descriptive analyses, the relationship between the investigated variables was assessed by calculating zero-order bivariate correlations. Next, a moderated moderation analysis that included a conditional indirect effect (see Fig. 1) was run (Process: model 14) to examine the multiple effects simultaneously (integration of the hypothesized mediation model and the hypothesized moderation model) (Edwards & Lambert, 2007; Hayes, 2018). The moderated mediation effect was assessed by the bootstrapping procedure (10,000 samples). It provides percentile bootstrap confidence intervals (*CI* 95%). The analyses included burden caused by Covid-19 as predictor, sense of control as mediator, anxiety symptoms as moderator and addictive SMU as outcome; controlling for the covariates age and gender. Path *a* denoted the relationship between burden and sense of control; path *b* denoted the association between sense of control and addictive SMU; path *c'* (the direct effect) denoted the link between burden and addictive SMU after the inclusion of sense of control and anxiety symptoms in the model.

3. Results

Table 1 presents the descriptive statistics of the investigated variables and their correlations. Burden by Covid-19 was significantly positively correlated with sense of control, anxiety symptoms and addictive SMU (all: $p < .001$). Sense of control was significantly positively correlated with anxiety symptoms and addictive SMU (all: $p < .001$). Further, anxiety symptoms were significantly positively

correlated with addictive SMU ($p < .001$) (see Table 1).

The results of the moderated mediation analysis are shown in Table 2. The overall model was significant, $F(6,543) = 12.463, p < .001$. The explained variance of the overall model was $R^2 = 0.176$. The effect of burden by Covid-19 on sense of control (path *a*), the effect of sense of control of addictive SMU (path *b*), and the effect of the interaction of sense of control and anxiety symptoms on addictive SMU were significant. The direct effect (path *c'*) of burden by Covid-19 on addictive SMU was not significant ($p = .075$) after controlling for sense of control, anxiety symptoms, and their interaction. The conditional indirect effect of burden on addictive SMU through sense of control was not significant in participants with low levels of anxiety symptoms. In contrast, it was significant in participants with medium and high levels of anxiety symptoms. As shown in Table 2, this effect was stronger for participants who expressed a high level of anxiety symptoms than for participants who expressed a medium level of anxiety symptoms. As indicated by the index of moderated mediation, the test of moderated mediation was significant revealing a significant moderated mediation effect. Thus, the findings reveal that sense of control mediated the association between burden by Covid-19 and addictive SMU: The higher the burden, the lower the sense of control and the higher addictive SMU. Furthermore, the conditional indirect effect of burden by Covid-19 on addictive SMU through sense of control was moderated by the level of anxiety symptoms: The higher the level of anxiety symptoms, the stronger the effect.

4. Discussion

The present study investigated potential consequences of the current Covid-19 crisis. The results show that the burden caused by the pandemic has the potential to enhance the level of addictive SMU. Moreover, they add to literature by providing an explanation of how sense of control and anxiety symptoms can be involved in this relationship.

As expected, burden caused by Covid-19 was positively associated with addictive SMU (confirmation of Hypothesis 1a). Sense of control was negatively associated with burden (confirmation of Hypothesis 1b) and with addictive SMU (confirmation of Hypothesis 1c), and it also mediated the relationship between both variables (confirmation of Hypothesis 1d). Thus, it can be assumed that burden by Covid-19 could reduce the sense of control, and this could contribute to the increase of addictive tendencies.

The findings correspond to Skaff (2007) who described that

Table 1
Descriptive statistics and correlations of burden by Covid-19, sense of control, anxiety symptoms and addictive social media use.

	M(SD)	*Min–Max*	(2)	(3)	(4)
(1) Burden by Covid-19	23.41 (6.20)	6–40	.297**	.333**	.211**
(2) Sense of Control	2.74 (1.97)	0–8		.425**	.253**
(3) Anxiety Symptoms	2.45 (3.15)	0–20			.316**
(4) Addictive SMU	10.86 (4.38)	6–29			

Notes. N = 550; SMU=Social Media Use; *M* = Mean, *SD*=Standard Deviation, Min = Minimum, Max = Maximum; Sense of Control: the higher the value, the lower sense of control; **$p < .001$.

Table 2
Moderated Mediation Model (outcome: addictive social media use).

	ß	SE	t	p	95% *CI*
Path *a*: Burden → Control	.096	.015	6.490	<.001	[.067, .125]
Path *b*: Control → Addictive SMU	.282	.113	2.488	.013	[.059, .505]
Interaction: Control*Anxiety Symptoms → Addictive SMU	.085	.031	2.775	.006	[.025, .145]
Path *c'* (direct effect): Burden → Addictive SMU	.057	.032	1.783	.075	[-.006, .119]
Conditional Indirect Effects: Burden → Addictive SMU					
Burden → Control → Addictive SMU					
Anxiety Symptoms:					
Low (one SD below mean = -2.453)	.007	.013			[-.017, .033]
Medium (mean = 0)	.027	.011			[.007, .050]
High (one SD above mean = 3.152)	.053	.016			[.023, .084]
Index of Moderated Mediation	.008	.003			[.002, .014]

Notes. N = 550; covariates: age and gender; Control = Sense of Control; SMU=Social Media Use; ß = Standardized Beta, SE=Standard Error, t = *t*-test, *p* = significance, *CI* = Confidence Interval.

burdensome experiences can reduce beliefs about one's control over a specific situation and/or the life in general. Individuals with low sense of control are prone to negative mental health outcomes such as depression symptoms and burnout (Southwick & Southwick, 2018). Moreover, they tend to engage in dysfunctional behavior to perceive at least some form of control such as enhanced alcohol use, overeating or restrictive eating behavior. In the longer-term, the maladaptive coping strategies often result in serious mental disorders (Lewer, Bauer, Hartmann, & Vocks, 2017; Polivy & Herman, 2002; Volpicelli, 1987).

Present results show that the framework presented by Skaff (2007) can be transferred to the outbreak of Covid-19 and the problematic use of SM. The current extraordinary situation is experienced as a heavy burden by many people (Brailovskaia & Margraf, 2020; Bueno-Notivol et al., 2020.; Paredes et al., 2020). Some people had to completely change their daily routine, without customary activities such as in-person meetings with colleagues, family and friends, traveling and visiting mass events. The feeling of control loss over personal lifestyle and life rhythm increased (Galea et al., 2020; Taylor et al., 2020). Considering the present results, the control loss in offline life seems to foster the search for a substitute on SM such as Facebook, Instagram and Twitter where users have many possibilities to satisfy their needs for self-presentation and social interaction (Vilnai-Yavetz & Tifferet, 2015). As a consequence, the intensity of SMU increased during the Covid-19 outbreak (Gao et al., 2020). "Social distancing" – a measure to reduce the pandemic spread – and the increased time spent at home because of home-schooling and work loss or reduced working times fostered the escape into the online world (Cellini, Canale, Mioni, & Costa, 2020).

Intensive SMU can satisfy different needs such as the search for positive emotions, and the reduction of negative ones (Lee, Lee, Moon, & Sung, 2015). It can decrease feelings of loneliness and foster the perception of social support and belonging and it can provide the experience of having at least some control over one's own life (Vilnai-Yavetz & Tifferet, 2015). However, as supported by the current findings, the positive experiences can contribute to the development of an emotional bond to the social platform and thus to the increase of addictive tendencies (Brailovskaia, Schillack, & Margraf, 2020). Similar to problematic alcohol use and eating behavior (Lewer et al., 2017; Volpicelli, 1987), individuals with enhanced levels of addictive SMU tend to lose control over their online behavior without being aware of it (Andreassen et al., 2017). This creates a vicious cycle of search for control and addictive SMU feeding into each other (Marino et al., 2018).

However, the present findings show that not all people who experience burden caused by the current Covid-19 situation and have a low sense of control over important areas of life are at similar risk for addictive SMU. In line with previous research (Atroszko et al., 2018; Primack et al., 2017), anxiety symptoms were negatively associated with sense of control (confirmation of Hypothesis 2a) and positively with addictive SMU (confirmation of Hypothesis 2b). Moreover, anxiety symptoms moderated the relationship between both variables (confirmation of Hypothesis 2c). The higher the anxiety symptoms, the closer the association between low sense of control and high addictive SMU. Specifically, the relationship between sense of control and addictive SMU was significant only for individuals with a medium or high level of anxiety symptoms. The following considerations may at least partly explain this finding. Theoretically, social platforms are a never-ending and always available source of positive experiences. SMU can evoke feelings of being protected from overwhelming problems, of relief and happiness (Mauri, Cipresso, Balgera, Villamira, & Riva, 2011). Individuals with enhanced anxiety symptoms are characterized by a low level of such feelings (Michael, Zetsche, & Margraf, 2007). On social platforms, they can experience all the positive feelings and a reduction of anxiety symptoms (Ryan & Xenos, 2011). This can contribute to the development of a close emotional bond to the SM and the strong wish to permanently immerse into the online world for mood improvement without perceiving alternative ways – symptoms of addictive SMU (Ryan et al., 2014). This process is fostered by low sense of control that

also belongs to the characteristic of people with enhanced anxiety symptoms (Kroenke, Spitzer, Williams, Monahan, & Löwe, 2007). Thus, it can be hypothesized that the combination of reduced sense of control and enhanced anxiety symptoms strengthens the emotional bond to SM and contributes to addictive tendencies. In contrast, people who experience a loss of control but have low levels of anxiety symptoms seem not to be at risk or at lower risk for enhanced addictive tendencies.

The present findings reveal that burden caused by Covid-19 can reduce the sense of control; reduced sense of control can increase addictive symptoms, but only when anxiety symptoms are at a high (or medium) level. Considering these relationships, it seems possible to reduce the potential negative consequences of Covid-19 with respect to mental health. First, it is important to publicly communicate current and previous results (e.g., Marino, et al., 2018) to raise awareness of potential negative consequences of intensive online activity. As many people are not aware of the impact of SMU on their health. Second, it is urgent to enhance the individual sense of control and to reduce anxiety symptoms. Available literature reports that a conscious reduction of daily time spent on SM significantly decreases anxiety symptoms. Moreover, it contributes to the increase of physical activity (Brailovskaia, Ströse, Schillack, & Margraf, 2020; Hunt, Marx, Lipson, & Young, 2018). Regularly physical exercises such as jogging, cycling or swimming, and a steady improvement of one's sportive performance foster the individual's sense of control, the experience of positive emotions and can reduce anxiety symptoms (Bailey, Hillman, Arent, & Petitpas, 2013). Moreover, earlier research showed that physical activity buffers the negative effect of depression and stress on mental health and reduces the level of addictive SMU (Bueno-Notivol et al., 2020.; Brailovskaia, Teismann, & Margraf, 2018; Wunsch, Kasten, & Fuchs, 2017).

Additionally to physical activity, previous research emphasized the protective effect of mindfulness – the increased attention to and the nonjudgmental awareness of the present moment (Bishop et al., 2004; Randal, Pratt, & Bucci, 2015). Mindfulness can reduce the level of social anxiety and of addictive SMU (Apaolaza et al., 2019). It fosters the individual sense of control and self-esteem and can improve the ability to cope adequately with extraordinary situations (Brown & Ryan, 2003). There is a positive relationship between mindfulness and physical activity (Heidenreich & Michalak, 2003; Michalak, Burg, & Heidenreich, 2012). Furthermore, both can enhance the individual level of resilience that is an important protective factor of mental health (Rebar et al., 2015; Zarotti, Povah, & Simpson, 2020). Resilience is defined as the ability to cope with stressful situations by involving individual resources (Southwick, Bonanno, Masten, Panter-Brick, & Yehuda, 2014). People with high levels of resilience are characterized by a high sense of control, self-esteem and problem-solving abilities (Masten, 2001). They are at less risk to engage in dysfunctional behavior that can negatively impact mental health (Collishaw et al., 2007). Previous cross-national research described that resilience can contribute to the reduction of anxiety symptoms (Brailovskaia, Schönfeld, et al., 2018). In a recent study, resilience served as a significant moderator of the positive association between threat by Covid-19 and future anxiety. Specifically, the higher the level of resilience, the weaker the link between threat by Covid-19 and future anxiety (Paredes et al., 2020). Moreover, resilience was negatively linked to addictive SMU (Brailovskaia, Schillack, & Margraf, 2018). Thus, governmental programs for protection of mental health specifically in times of Covid-19 should focus on the reduction of SMU and promote physical activity and mindfulness. Additionally to campaigns that encourage the user to consciously control and decrease the own time spent online, examples of physical activity that do not require expensive equipment can be provided in advertising campaigns on TV, officials governmental online sites and billboards. The offer of mindfulness training via online chats and videotelephony can be promoted and enhanced. These steps can longitudinally contribute to the reduction of negative consequences of the current Covid-19 situation.

Furthermore, research on earlier threats of diseases shows that the form of public risk communication by national governments can

significantly impact the population response to the extraordinary situation (Mondor et al., 2012). Governmental communication that emphasizes the significance of the individual behavior and the importance of adherence to the introduced measures such as the wearing of face masks and maintaining of distance in public places can additionally foster the sense of control among the population (Gandhi & Rutherford, 2020). In addition, some people with Covid-19 symptoms might be reluctant to coming forward because they are afraid of potential prejudices. Therefore, the governmental communication can stress that only the coming forward enables an adequate therapy and fosters the reduction of the pandemic spread and mortality. A higher offer of psychotherapeutic low-threshold online support can contribute to the reduction of individual anxiety considering potential prejudices. To sum up, actions that increase the sense of control and reduce anxiety symptoms as well as SMU can decrease the potential negative impact of burden caused by Covid-19 and protect people's mental health.

Following limitations of the present study are to be considered. First, the cross-sectional online survey design allows only hypothetical conclusions of causality. Note that the present data were collected via an online survey in spring 2020 during the lockdown in Germany (Bundesministerium für Gesundheit, 2020). Due to the need for "social distancing" and the closing of the research laboratories, experimental investigations were not possible. As currently some *anti*-Covid-19 measures have been eased, a replication of present findings in longitudinal experimental studies is desirable. Second, the relatively young and mostly female composition of the investigated sample limits the generalizability of the present results. To partly tackle this limitation, age and gender were controlled for in the analysis. Nevertheless, future studies are suggested to replicate the investigation in a more age and gender balanced sample. Third, the current sample included healthy participants. Future studies should investigate the moderated mediation model in clinical patients with diagnosed anxiety disorders. Based on the present results, it can be assumed that these individuals are at an especially high risk for addictive SMU during the pandemic outbreak. If this assumption is confirmed, the present findings can be integrated in the clinical context to support the therapeutic process. Fourth, the present findings are a snapshot of the Covid-19 situation in Germany in spring 2020 – when the investigated data were collected. Due to the highly dynamic circumstances of the pandemic that impact people's daily life around the globe, it should be investigated whether the present moderated mediation model that focused on the potential Covid-19 consequences for mental health can be confirmed in other countries and at later time points after the pandemic outbreak. Fifth, the found effects were relatively small. Therefore, future studies are suggested to investigate further potential moderators (e.g., personality traits) of the relationship between burden caused by Covid-19, sense of control and addictive SMU. Sixth, in the present study, the focus was on the general anxiety symptoms. Future research is suggested to replicate the present findings, especially the moderated mediation model, with specific forms of anxiety such as anxiety to be infected with Covid-19, anxiety to live with someone who might be infected, anxiety to coming forward with Covid-19 symptoms, or future anxiety considering specific areas of life (e.g., economic and social problems).

In conclusion, the present study shows that burden caused by Covid-19 can contribute to the increase of addictive SMU. Decreased sense of control combined with enhanced anxiety symptoms may significantly foster this relationship. Governmental intervention steps are necessary to prevent the negative consequences of the current Covid-19 crisis and therefore to longitudinally protect people's mental health.

CRediT author statement

Julia Brailovskaia: Conceptualization, Methodology, Software, Validation, Resources, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration. Jürgen Margraf: Conceptualization, Methodology,

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