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The relationship between sense of control, positive mental health, addictive social media use, and psychological burden caused by COVID-19: a longitudinal study

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Abstract

Since the COVID-19 outbreak, addictive social media use and psychological burden increased in many countries. Few studies have delved into the mechanisms underlying the occurrence of psychological burden and addictive social media use. This study explored the influence of sense of control and positive mental health before COVID-19 on addictive social media use and psychological burden after COVID-19. Data of 1745 participants from China were assessed in 2014 (T1), 1042 participants in 2016 (T2), 407 participants in 2020 (T3), 324 participants in 2021 (T4). Finally, a sample of 248 participants (195 females, Mage = 26.83, SD = 0.62 years at T4) completed the longitudinal study for eight years (2014–2021). The results showed that there was a significant relationship between sense of control and positive mental health negatively correlated with addictive social media use and psychological burden. The sense of control at T1 significantly predicted the positive mental health of T2. Then positive mental health of T2 predicted the addictive social media use of T3. Finally, the addictive social media use of T3 predict psychological burden at T4. This finding clarifies the relationship between sense of control, positive mental health, addictive social media use and psychological burden under COVID-19. It also proves that sense of control and positive mental health are protective factors to alleviate addictive social media use and psychological burden. Therefore, we should pay attention to the sense of control and addictive social media use among young people under COVID-19, which reduce the burden of COVID-19 on young people and contribute to their good mental health.

Keywords Sense of control · Positive mental health · Addictive social media use · Burden caused by COVID-19 · Longitudinal study

Introduction

The rapid spreading of COVID-19 has significantly changed people's daily life (World Health Organization, 2020). Many governments and authorities introduced restrictive rules to fight the pandemics (Sohrabi et al., 2020), such as closing public institutions, bans on traveling, non-family gathering and maintaining social distance (Galea et al., 2020). These measures decreased how much control people feel they have over their own live and put psychological burden on people (Brailovskaia & Margraf, 2022a; Huang & Zhao, 2020; Tang et al., 2021). At the same time, due to long-term quarantine and lockdown, people obtain news and stay in touch with others via telephone and social media, and play games and watch videos for entertainment (Cellini et al., 2020; Ohme et al., 2020; Thomas et al., 2021). The characteristics of addictive social media use

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also increased (Masaeli & Farhadi, 2021). More researchers describe the lack of sense of control and decrease of level of positive mental health that put psychological burden on people during COVID-19 (Brailovskaia & Margraf, 2020a, b; Brailovskaia et al., 2021c). However previous researches have not systematically examined the relationship among sense of control, positive mental health, addictive social media use, and psychological burden caused by COVID-19 (Brailovskaia & Margraf, 2020a, b, 2021, 2022b). Therefore, the current study aimed to investigating the impact of sense of control and positive mental health on addictive social media use, and psychological burden by COVID-19, concurrently and longitudinally.

Sense of control (SOC) and positive mental health (PMH) are protective factors that buffer the influence of negative events and reduces the risk of mental disorders (Brailovskaia & Margraf, 2022c). Sense of control refers to we try to control what is happening around us and to decide what to do, where to go (Brailovskaia & Margraf, 2022a). Loss of control over daily life evokes negative emotional discomfort, such as anxiety symptoms (Taylor et al., 2020; Xiong et al., 2020), despair, depression and confusion filling with daily life (Salari et al., 2020). People who experience almost facets of their life as uncontrollable tend to immoderately engage in social media use (SMU) (Apaolaza et al., 2019; Brailovskaia et al., 2020).

Specifically, people felt less control of life during COVID-19 (Taylor et al., 2020; Xiong et al., 2020), which led to more use of social media and even addiction to social media (Brailovskaia & Margraf, 2021). On social platforms, people learn about news of COVID-19, reduce social distance, and escape negative emotions (Brailovskaia & Margraf, 2022c; Marino et al., 2018). This contributes to the impression to regain some control over important areas of their life (Ryan et al., 2014). However, positive online experiences contribute to a strong need to stay permanently online (Brailovskaia et al., 2020). This phenomenon has been termed as addictive SMU (Andreassen et al., 2017). The Interaction of Person-Affect-Cognition-Execution (I-PACE) model for addictive behavior shows that, in the longer-term, due to the interaction between different moderating and mediating factors, the immoderate online activity contributes to the development of addictive tendencies and increases conflicts in the offline world (Brand et al., 2016). Therefore, it is important to identify potential factors that contribute to the addictive tendencies and to understand their interaction.

Positive mental health refers to a high level of subjective well-being, psychological well-being and social well-being (Keyes, 2005). Individuals with higher levels of positive mental health usually have a high sense of control and adapt to uncertainty and emergencies (Brailovskaia, & Margraf, 2022b; Niemeyer et al., 2019). Positive mental health and Sense of control negatively predicted addictive social media use (Brailovskaia & Margraf, 2021; Brailovskaia et al., 2019). Positive mental health contributes to one's sense of control (Seligman, 1972) and high sense of control is related to low addictive social media use. The sense of control is the protective factor of mental and emotional health (Lachman et al., 2008). Therefore, further research should investigate the underlying mechanisms of how sense of control and positive mental health predict addictive social media use. Previous studies mostly focused on concurrent effects, and rarely explored the directional issues and longitudinal effects on addictive social media use between sense of control and positive mental health.

The burden caused by the COVID-19, refers to the adverse reactions caused by the COVID-19. That is individuals feel a strong sense of uncertainty, anxiety and depression (Brailovskaia & Margraf, 2020a). Individuals have lost control of their daily life to some extent due to the COVID-19, for example, people do not meet often or travel, which has caused burden (Taylor et al., 2020; Xiong et al., 2020). However, if the individual has a higher level of positive mental health, they will be more adaptable, resilient and more willing to set life goals (Zhang & Schwarzer, 1995). Therefore, the psychological burden will be lower (Teismann et al., 2019). Thus, it might be that positive mental health mediates the relationships between sense of control and psychological burden.

Social media use is closely related to the burden caused by COVID-19 (Brailovskaia & Margraf, 2021; Brailovskaia et al., 2021a). Brailovskaia et al. (2021c) found in the longitudinal studies in Germany and Italy that participants were using social media as a way to know about the COVID-19. Excessive use of social media led to increase in burden caused by COVID-19, in which stress symptoms play a mediator role. Burden caused by COVID-19 affect the social media use in turn (Brailovskaia et al.,, 2022). Psychological burden positively predicts social media use and even leads to addictive social media use (Brailovskaia et al., 2020).

Previous studies have not systematically examined the relationship between the four variables. And most of the existing studies investigate the immediate effects, and there is a lack of research examining the longitudinal effects of sense of control and positive mental health on social media addiction and psychological burden (Brailovskaia & Margraf, 2021; Brailovskaia et al., 2020, 2022, 2021a, b, c). High sense of control is associated with high positive mental health (Brailovskaia, & Margraf, 2022b; Niemeyer et al., 2019). Sense of control and positive mental health are both negatively associated with addictive social media use and psychological burden (Brailovskaia & Margraf, 2021; Brailovskaia et al., 2019). Addictive social media use is associated with psychological burden (Brailovskaia &

Margraf, 2021; Brailovskaia et al., 2021a). Therefore, four path hypotheses are proposed: (1) Sense of control at T1 positively predicts positive mental health at T2, and then positive mental health at T2 negatively predicts addictive social media use at T3, and finally addictive social media use at T3 positively predicts psychological burden at T4. (2) Positive mental health at T1 positively predicted sense of control at T2, then sense of control at T1 negatively predicted addictive social media use at T3, and finally addictive social media use at T3 positively predicted psychological burden at T4. (3) Sense of control at T1 positively predicted positive mental health at T2, and then positive mental health at T2 negatively predicted psychological burden at T3, and finally social psychological burden at T3 positively predicted the psychological burden of addictive social media use at T4. (4) Positive mental health at T1 positively predicted sense of control at T2, then sense of control at T2 negatively predicted psychological burden at T3, and finally psychological burden at T3 positively predicted addictive social media use at T4.

Method

Participant

This study was conducted as part of the Bochum Optimism and Mental Health (BOOM) research. We sampled the students in a cluster (Huang et al., 2023). We invited all students from the five departments, which are labeled as the representative departments of the university, and we respected students' views if they did not wish to participate despite knowledge of the project. The location of these five departments in the university is relatively concentrated, which is convenient for us to conduct data collection. The first test was conducted in June 2014 (T1), and 1745 valid questionnaires were recovered. The second test was conducted in June 2016 (T2). We recovered 1042 valid questionnaires due to the change of campus and the absence because of senior internship. Due to the graduation of the participants and the COVID-19 epidemic, the third test (in May 2020) was online. We collected 407 valid online questionnaires. The fourth online test was conducted in 2021, and a total of 324 valid questionnaires were collected. The follow-up study lasted for a long time. Although we previously maintained the participant participation rate through telephone and SMS return visits, increased remuneration, improved detailed feedback reports, and alumni return activities, many participants still dropped out of the study. At the same time, due to the aggravation of the epidemic, the participants were further lost. Finally, a sample of 248 participants completed four times questionnaires. There was no significant difference in sense of control ($t = 1.87$, $p = 0.06$), psychological mental health ($t = -1.60$, $p = 0.11$), burden ($t = 0.019$, $p = 0.99$) and addictive social media use ($t = -1.15$, $p = 0.25$) scale scores between the final 248 participants and the total 1745 participants at T1 indicating that a random drop out. The average age of the sample (T4) was 26.83 ± 0.62 years old, and the age range was 26–30 years old. Table 1 shows an overview of the participants characteristics.

Table 1 Demographic characteristics of the sample

	T1	T2	T3	T4
Gender				
Male	-	236 (22.6%)	84 (20.6%)	74 (22.8%)
Female	-	806 (77.4%)	323 (79.4%)	250 (77.2%)
Marital status				
Unmarried (with a regular partner)	1423 (81.6%)	857 (82.2%)	177 (43.5%)	117 (36.1%)
Unmarried (without a regular partner)	313 (17.9%)	176 (16.9%)	127 (31.2%)	91 (28.1%)
Married or divorced	9 (0.5%)	9 (0.9%)	103 (25.3%)	116 (35.8%)
Department	-			
Humanities	-	291 (27.9%)	96 (23.6%)	76 (23.5%)
Education	-	229 (22.0%)	139 (34.1%)	106 (32.7%)
Science	-	276 (26.5%)	78 (19.2%)	64 (19.7%)
Mathematics	-	242 (23.2%)	87 (21.4%)	72 (22.2%)
Architecture	-	4 (0.4%)	7 (1.7%)	6 (1.9%)
Socioeconomic status				
Lower middle level	-	-	32 (7.9%)	-
Middle level	-	-	307 (75.4%)	-
Upper middle level	-	-	68 (16.7%)	-

T1 baseline (2014), *T2* second follow-up (2016), *T3* third follow-up (2020), *T4* fourth follow-up (2021)

Measures

Sense of control

Niemeyer et al. (2019) Sense of Control Scale was selected to assess sense of control by two-item scale. Both items are rated on a 5-point Likert-type scale (1 = not at all, 5 = fully). We reversed the items for the sum score calculation. The higher the sum score indicates higher sense of control. The Cronbach's alpha coefficients were 0.72 (T1), 0.77 (T2), 0.84 (T3), and 0.92 (T4). The scale reliability of previous study was 0.810 (Brailovskaia & Margraf, 2021) and 0.792 (Brailovskaia et al.,, 2021b). Previous scale reliability of eight countries (China, France, Germany, Poland, Russia, Spain, Sweden, U.K., U.S.) ranges between α = 0.790 (Poland) and 0.912 (Spain) (Brailovskaia, & Margraf, 2022b).

Positive mental health

Positive mental health was assessed by The Unidimensional Positive Mental Health Scale (Lukat et al., 2016), which contains nine items (e.g., "I am often in a relaxed and happy mood," "I enjoy my life,"). Items are rated on a 4-point Likert-type scale (1 = does not meet, 4 = fully meets). Higher total scores demonstrate higher positive mental health. The Cronbach's alpha coefficients were 0.89 (T1), 0.92 (T2), 0.94 (T3), and 0.95 (T4). The PMH-scale showed good psychometric properties in non-Western samples and exhibited strong cross-cultural measurement invariance across student samples from Germany, Russia and China (Bieda et al., 2017; Velten et al., 2018). In previous study, the internal consistencies of the PMH-scale at three Chinese universities were excellent (α = 0.90–0.93) (Bieda et al., 2019).

Addictive social media use

The Bergen Social Media Addiction Scale (BSMAS) (Andreassen et al., 2017) measured addictive social media use. The scale includes six items with 5-point Likert-type scale (e.g., "How often did you increasingly crave social media in the last year?"; 1 = almost never, 5 = often/very often). Higher sum score indicates higher the level of addictive social media use. The Cronbach's alpha coefficients were 0.86 (T3) and 0.86 (T4). The scale reliability of previous study ranged between Cronbach's α = 0.815 (China) and α = 0.901 (Germany) (Brailovskaia, & Margraf, 2022b).

Burden caused by COVID-19

The Burden Caused by COVID-19 Scale (Brailovskaia & Margraf, 2020a, b) assessed the psychological burden of participants in the epidemic. The scale includes six items that related on a 7-point Likert-type scale (e.g., "I feel restricted in my daily life"; 1 = I disagree, 7 = I fully agree). The higher the sum score, the higher level of the psychological burden. Factor analysis indicated that first four items fitted better. We selected the first four items to measure the participants' level of psychological burden. The Cronbach's αwere 0.81 (T3) and 0.83 (T4). The scale reliability of previous study was 0.749 (Brailovskaia, & Margraf, 2021).

Procedure

We selected undergraduate students of a university in Shanghai as participants. Written consent was obtained from all undergraduate students. They reported questionnaires in 2014, 2016, 2020, and 2021 respectively. In the first two administered tests (in 2014, 2016), undergraduates were asked to complete the paper questionnaire in the classroom, and the administered test took about 20 min. Due to the spread of the COVID-19, the last two tests (in 2020, 2021) were conducted online, and the links were sent to the participants who were willing to participate. It took about 7 min for the participants to complete the entire assessment content.

Statistical methods

Two statistical steps were conducted in the current study. First, descriptive statistics and correlational analyses were conducted using SPSS 24.0. Second, we examined the interactions among study variables and their mutual predictive relationships with the structural equation model.

Results

Descriptive results

A series of mixed repeated measures MANOVA was conducted to examine the effects of gender, time, and their interactions with each variable. The significant main effects of gender for Positive mental health [$F(2,245) = 7.82, p < 0.01, \eta^2_P = 0.03$] and sense of control [$F(2,245) = 4.56, p < 0.05, \eta^2_P = 0.018$] were reported. Female had significantly higher in positive mental health and sense of control than male. Results indicated a significant main effect of Time for sense of control [$F(3,244) = 10.26, p < 0.001, \eta^2_P = 0.04$], showing a trend of first decreasing (T1-T2) and then rising(T2-T3-T4). Results also indicated a significant main effect of Time for psychological burden [$F(2,245) = 10.69, p < 0.05, \eta^2_P = 0.042$]. The psychological burden of T3 was significantly higher than that of T4. There was no significant

Gender×Time Interaction for each variable. The descriptives of the variables used in our analyses are represented in Table 2. All correlations between all variables are showed in Table 3. Sense of control at T2 was not associated with positive mental health at T3 ($r=0.11$), and significant positive associations were found between sense of control and positive mental health within and across years ($r=0.13$ to 0.68).

There was no relationship between the sense of control at T1 and addictive social media use at T4 ($r=$-0.04), nor was there a relationship between the sense of control at T1 and the burden caused by COVID-19 at T3 ($r=$-0.10) and the burden at T4 ($r=$-0.07). Sense of control was a significant negative correlation between addictive social media use ($r=$-0.39 to -0.14) and burden ($r=$-0.41 to -0.14) at each year and across years.

There was no relationship between T1's positive mental health and T3's addictive social media use ($r=$-0.08). Significant negative correlations were found between sense of control and addictive social media use ($r=$-0.19 to -0.13) and burden ($r=$-0.54 to -0.17) at each year and across years.

In addition, there was a significant positive relationship between burden and addictive social media use at each year and across years ($r=0.22$ to 0.61).

Structural equation model of sense of control, positive mental health, addictive social media use, and burden caused by COVID-19

Structural equation models were constructed to examine the effects of sense of control and positive mental health before the COVID-19 on addictive social media use and burden caused after the COVID-19. The model fit ($\chi 2/df=1.85$, IFI=0.88, TLI=0.87, CFI=0.88, RMSEA=0.06) was not good. Pathways that do not significantly was removed, including the pathway of T1's sense of control and positive mental health to T3's addictive social media use and psychological burden, and the pathway of T2's sense of control and positive mental health to T4's addictive social media use and psychological burden. The model had a good fitting index, $\chi 2/df=1.39$, IFI=0.95, TLI=0.94, CFI=0.94, RMSEA=0.04 (Fig. 1). After controlling for the autoregression effect of each variable, sense of control at T1 significantly positively predicted positive mental health at T2 ($\beta=0.13$, $p<0.05$). Sense of control at T2 did not significantly predict psychological burden ($\beta=$-0.11, $p>0.05$) and addictive social media use at T3 ($\beta=$-0.12, $p>0.05$), but sense of control at T1 predicted psychological burden caused by COVID-19 and addictive social media use at T3 by predicting positive mental health at T2. Positive mental health at T1 did not significantly predict sense of control at T2 ($\beta=0.11$, $p>0.05$). Positive mental health at T2 significantly negatively predicted mental burden at T3 ($\beta=$-0.23, $p<0.01$) and addictive social media use at T3 ($\beta=$-0.21, $p<0.01$).

In addition, burden at T3 did not significantly predict addictive social media use at T4 ($\beta=0.04$, $p>0.05$), but addictive social media use at T3 significantly positively predicted burden at T4 ($\beta=0.29$, $p<0.001$).

The results show that sense of control at T1 predicted positive mental health at T2 positively, then positive mental health at T2 negatively predicted addictive social media use at T3. Finally addictive social media use at T3 predicted burden at T4.

Discussion

The purpose of this study was to investigate the relationships among sense of control, positive mental health, addictive social media use, and burden caused by COVID-19, and to explore whether sense of control and positive mental health before the COVID-19 predict addictive social media use and burden after the COVID-19. We have four path hypotheses: (1) Sense of control positively predicts positive mental health, and then positive mental health negatively predicts addictive social media use, and finally addictive social media use positively predicts psychological burden. (2) Positive mental health positively predicted sense of control, then sense of control negatively predicted addictive social media use, and finally addictive social media use positively predicted psychological burden. (3) Sense of control positively predicted positive mental health, and then positive mental health negatively predicted psychological burden, and finally psychological burden positively predicted the addictive social media use. (4) Positive mental health positively

Table 2 Mean and standard deviation (SD) of sense of personal control, positive mental health, addictive social media use, and psychological burden at each time point

	T1		T2		T3		T4	
	n	M(SD)	*n*	M(SD)	*n*	M(SD)	*n*	M(SD)
SOC	1745	3.43(0.85)	1042	3.27(0.81)	407	3.56(0.91)	324	3.70(0.96)
PMH	1745	3.24(0.25)	1042	3.30(0.53)	407	3.27(0.56)	324	3.28(0.57)
Burden	-		-		407	2.71(1.20)	324	2.58(1.20)
Addictive SMU	-		-		407	2.17(0.87)	324	2.19(0.90)

SOC the sense of control, *PMH* positive mental health; Burden, burden caused by COVID-19; *Addictive SMU* addictive social media use, *T1* baseline (2014), *T2* second follow-up (2016), *T3* third follow-up (2020), *T4* fouth follow-up (2021); $^{*}p<.05$, $^{**}p<.01$, $^{***}p<0.001$

Table 3 Results of correlation analysis for each variable

	1	2	3	4	5	6	7	8	9	10	11	12
1. SOCT1	1											
2. PMH T1	0.30**	1										
3. SOCT2	0.28**	0.20**	1									
4. PMH T2	0.26**	0.54**	0.28**	1								
5. SOCT3	0.30**	0.18**	0.29**	0.25**	1							
6. Burden T3	-0.18**	-0.17**	-0.14*	-0.21**	-0.35**	1						
7. Addictive SMU T3	-0.10	-0.08	-0.14*	-0.18**	-0.39**	0.27**	1					
8. PMH T3	0.24**	0.42**	0.11	0.52**	0.37**	-0.41**	-0.20**	1				
9. SOCT4	0.25**	0.19**	0.24**	0.17**	0.37**	-0.31**	-0.26**	0.29**	1			
10. Burden T4	-0.07	-0.25**	-0.15*	-0.35**	-0.37**	0.51**	0.35**	-0.44**	-0.41**	1		
11. Addictive SMU T4	-0.04	-0.13*	-0.20**	-0.15*	-0.22**	0.22**	0.61**	-0.17**	-0.36**	0.34**	1	
12. PMH T4	0.14*	0.42**	0.13*	0.47**	0.31**	-0.36**	-0.15*	0.68**	0.41**	-0.54**	-0.19**	1

SOC the sense of control, *PMH* positive mental health, *Burden* burden caused by COVID-19, *Addictive SMU* addictive social media use, *T1* baseline (2014), *T2* second follow-up (2016), *T3* third follow-up (2020), *T4* fouth follow-up (2021); $^{*}p < .05$, $^{**}p < .01$, $^{***}p < 0.001$

predicted sense of control, then sense of control negatively predicted psychological burden, and finally psychological burden positively predicted addictive social media use.

Positive mental health, sense of control, and the psychological burden of COVID-19

Positive mental health was positively related to the sense of control in terms of concurrent effects. This was consistent with the findings of Precht et al. (2021), in which sense of control was significantly positively correlated with positive psychological burden, and sense of control was a protective factor for mental health (Lachman et al., 2008). In terms of the longitudinal effect, the sense of control predicts positive mental health at the next time point, while positive mental health did not predict the sense of control at the next time point. The path hypothesis 2 and 4 are untenable.

The prediction of psychological burden by positive mental health is the same as the research results of Brailovskaia and Margraf (2020a), which confirms that positive mental health is an important protective factor for individuals, buffer the negative effects of daily stress and cultivate adaptive coping strategies (Brailovskaia & Margraf, 2020a, b). Previous studies found that individuals' positive mental health in 2019 predicted the psychological burden in 2020 (Brailovskaia & Margraf, 2020a). This study finds that the prediction is extended to a longer interval. Individuals' positive mental health in 2016 significantly predicts the individuals' psychological burden of COVID-19 in 2020, indicating that the protective effect of positive mental health exists for a long time.

The sense of control reduces the burden caused by Covid-19, which is the same as the conclusions of other studies (Brailovskaia & Margraf, 2020a). Sense of control at T1 predicts burden at T3 through positive mental health at T2. The high sense of control does not directly help individuals reduce their psychological burden caused by the COVID-19, but sense of control helps individuals build positive mental health and enable them to have more positive emotions and positive psychological states. Therefore, individuals reduce the psychological burden caused by the COVID-19 (Brailovskaia et al., 2020).

Positive mental health, sense of control, and addictive social media use

We found that positive mental health at T2 negatively predicts addictive social media use at T3. Sense of control at T2 does not predict addictive social media use at T3. However, sense of control at T1 is protective factor of addictive social media use at T3 through T2's positive mental health at T2.

The relationship between positive mental health and addictive social media use also confirms some other studies.

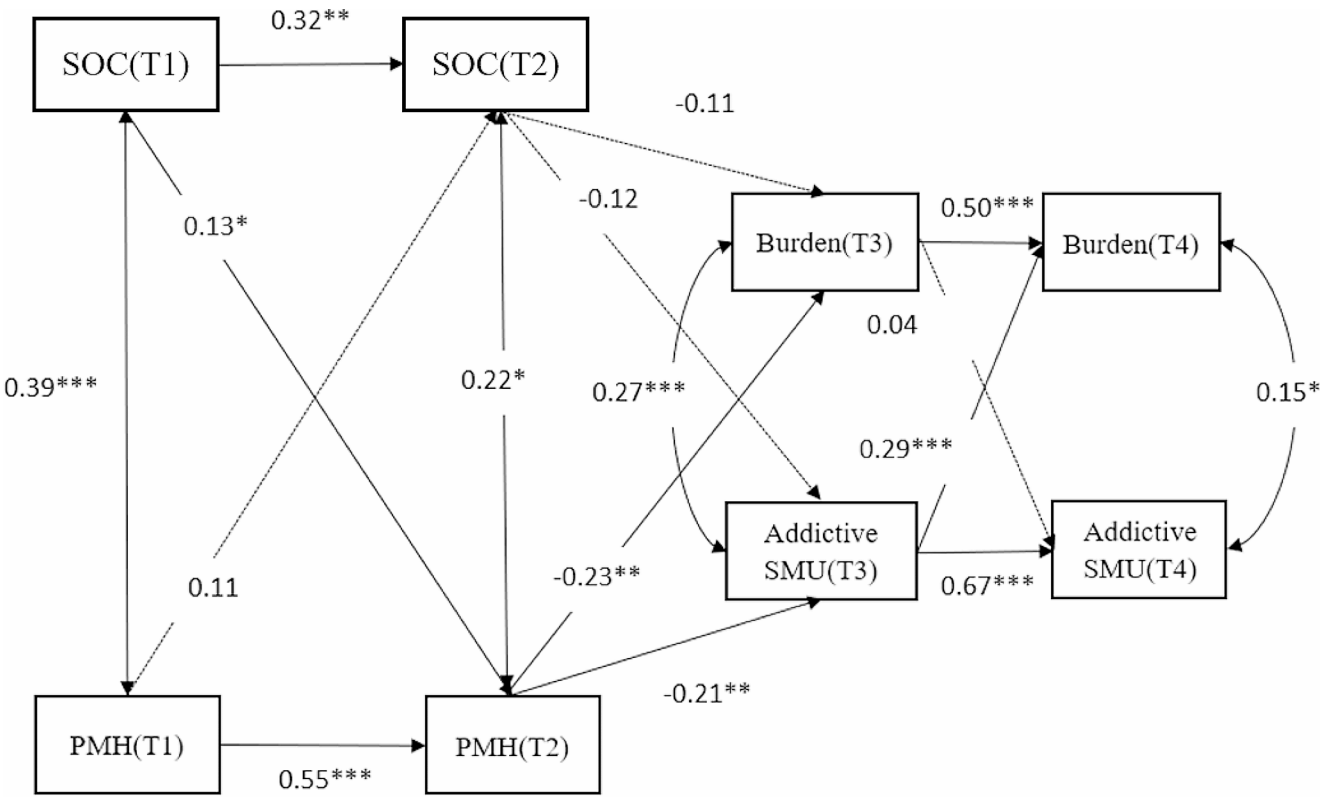

Fig. 1 Structural equation modeling of the sense of control, positive mental health, burden caused by COVID-19 and addictive social media use. *Note*. The standardized coefficients were displayed in Model. SOC, the sense of control; PMH, Positive Mental Health; Burden, burden caused by COVID-19; Addictive SMU, addictive social media use;*T1* baseline (2014), *T2* second follow-up (2016), *T3* third follow-up (2020), *T4* fourth follow-up (2021); $^{*}p<.05$, $^{**}p<.01$, $^{***}p<0.001$

Brailovskaia et al. (2020) also found a significant negative correlation between positive mental health and Facebook addiction in a longitudinal study. They discussed that positive mental health plays a mediating role between Facebook addiction and suicide, but this study did not explore whether positive mental health predict addictive social media use. Previous studies have focused on negative emotions as a predictor of addictive social media use (Yu et al., 2016), but few empirical studies have discussed the protective effect of positive mental health on addictive social media use. This study extends previous studies and finds that positive mental health is indeed a protective factor to prevent addictive social media use. Because positive mental health means that individuals have a high level of subjective well-being, psychological well-being and social well-being (Keyes, 2005). They show psychological resilience in the face of emergencies such as the COVID-19, and urge them to find more social support in real life rather than indulge in social media.

The study by Brailovskaia and Margraf (2021) found a negative correlation between the sense of control and addictive social media use. They believe that the psychological burden caused by the COVID-19 damages people's sense of control, resulting in the tendency of addictive social media use. However, the impact of sense of control on addictive social media use was based on the findings of cross-sectional researches. This study did not find that sense of control at T2 predicts addictive social media use at T3 longitudinally, which shows that the protective effect of sense of control on addictive social media use is only effective in the short term. This study also found that sense of control at T1 positively predicts positive mental health at T2, and then positive mental health at T2 predict T3's addictive social media use at T3. This shows that from a longitudinal perspective, the protective effect of sense of control on addictive social media use is achieved by improving the level of positive mental health. Brailovskaia and Margraf (2021) also found that the sense of control plays a mediating role in the process of burden caused by Covid-19 leading to addictive social media use, but this study is a cross-sectional study. Whether it still plays the same role under cross time conditions needs to be further tracked.

Positive mental health, sense of control, the psychological burden of COVID-19, and addictive social media use

This study found that the burden caused by COVID-19 of T3 and T4 was significantly positively correlated with the

addictive social media use in that year. The same result was found in the cross-sectional study of Brailovskaia and Margraf (2021). They found that the burden caused by the COVID-19 increased addictive social media use. From a longitudinal perspective, addictive social media use of T3 significantly predicts the psychological burden of T4. Brailovskaia et al. (2021a) also found the predictive effect of addictive social media use on the burden caused by COVID-19. In this study, the burden of T3 does not significantly predict the addictive social media use of T4. The existing cross-sectional studies have found that burden caused by COVID-19 caused addictive social media use (Brailovskaia & Margraf, 2021), but this result has not been confirmed under the longitudinal study of this research. It may be that burden cause addictive social media use in the short term, but not predict addictive social media use one year later. Moreover, the COVID-19 epidemic has been controlled stably, people go out of their homes for normal work and study from the second half of 2020. So, individuals do not have much time and opportunity to indulge in the use of social media.

On the basis of the above findings, the burden of T3 does not significantly predict the social media use addiction of T4. Hypothesis 1 of this study is untenable. However, we found that positive mental health at T1 predicts sense of control at T2, and then predicts sense of control at T2 affects psychological burden at T4 through addictive social media use at T3. The path hypothesis 3 of this study is tenable. Specifically, a higher sense of control at T1 enhances the positive mental health level of individuals at T2. A higher mental health level at T2 reduces the social media addiction at T3, and a lower addictive social media use on at T3 reduces the burden of individuals under the COVID-19. Sense of control at T1 predicted positive mental health at T2 in line with the fact that sense of control is a protective factor for positive mental health, while mental health at T2 predicted addictive social media use at T3 in line with research that positive mental health reduces addictive social media use. The effect of sense of control on addictive social media use is indirect and needs to be acted on through positive mental health. The less control individuals feel in their second year of college, the more negative emotions they have in their fourth year of college and the lower their level of positive mental health. This also means that when the COVID-19 occurred four years after graduation, they were more likely to indulge in social media and thus more likely to feel the restrictions brought about by the COVID-19, feeling a heavy psychological burden in the second year of the pandemic. These findings have important guiding significance in promoting the mental health of college students and helping adolescents reduce their psychological burden.

Limitations and implications

However, this study also has limitations. Firstly, this study mainly adopts the self-report of participants through questionnaire survey. It is hoped that in the future research, a variety of research methods are properly combined, such as interview and experiment, in order to obtain more accurate results. Secondly, the structural equation model of this study is more complex, but there is too much loss of participants. Theoretically, a larger participant size is more convincing. Finally, the participants in this study are from a university in Shanghai. The singleness of the sample may lead to the particularity of the research results, which is not conducive to the popularization and application of the research results. In our future studies, we intend to actively collaborate with research institutions or universities across the country. Additionally, we will enhance our online recruitment efforts through social media and online forums to ultimately involve a more diverse group of participants, representing a wide range of cultural backgrounds and socio-economic statuses.

Despite these limitations, this study explores the predictive role of sense of control and positive mental health on addictive social media use and the burden caused by the COVID-19 through an 8-year longitudinal design. For young individuals, the outbreak of COVID-19 inevitably brought negative effect and psychological distress (Usher et al., 2020). Exploring the influencing factors and mechanisms of psychological burden and addictive social media use will play an important role in improving young people's physical and mental health. The structural equation model of sense of control, positive mental health, addictive social media use and the burden caused by the COVID-19 shows that both sense of control and positive mental health are protective factors to reduce addictive social media use and burden under the COVID-19. Therefore, in the context of the COVID-19 or other emergencies, universities and relevant departments should call for individuals to participating in colorful activities, offering regular psychological lectures, employment guidance lectures, etc., to help them improve their sense of control over life and mental health. At the same time, individuals can establish a sense of control over life by setting and completing goals, limit the time to use social media and cultivate personal interests.

Conclusion

This study provides evidence for the longitudinal relationship between youth's sense of control, positive mental health, addictive social media use and the burden caused by the COVID-19. The positive mental health of individuals

before the COVID-19 predicts the addictive social media and burden after the COVID-19. The sense of control affects the addictive social media use and burden after the COVID-19 by improving the positive mental health. Sense of control at T1 enhances positive mental health at T2, followed by a reduction in social media addiction at T3. Ultimately, a lighter level of addictive social media use at T3 helps reduce psychological burden at T4. Therefore, the sense of control and positive mental health reduces burden and play an effective protective role, and high addictive social media use is a risk factor leading to psychological burden.

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Data availability The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical approval Ethical approval was obtained from the Research Ethics Committee of Corresponding Author's University. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee.

Informed consent Informed consent was obtained from all individual participants included in the study.

Conflict of interest All authors declare that they have no conflict of interest.

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