

Role of time perspectives and self-control on well-being and ill-being during the COVID-19 pandemic: A multiple mediation model

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Abstract

Background

A growing body of evidence indicates that the outbreak of COVID-19 has had a significant influence on individuals' cognition, emotion, and psychological health. This study aims to explore the effect of the association between time perspectives and self-control on the well-being and ill-being among college students in China during the COVID-19 pandemic.

Methods

We conducted an online survey involving 1,924 participants in mainland China during the outbreak of COVID-19. A series of self-rating questionnaires measuring the perceived impact of COVID-19, time perspectives, self-control, as well as the statuses of well-being and ill-being were administered. Multiple indirect effects of time perspectives and self-control on well-being and ill-being were analysed through structural equation modelling.

Results

The present-hedonistic time perspective (an orientation on immediate impulses of pleasure) mediated the effects of perceived impacts on both well-being and ill-being, and the future time perspective (considering the outcomes of actions and decisions) mediated the effects on well-being. Moreover, the mediating effects were further mediated by self-control. Specifically, the impact of the future time perspective on ill-being was fully mediated by self-control ($\beta = 0.01$, $p < 0.01$).

Conclusion

Based on the results, it is evident that the present-hedonistic time perspective, the future time perspective, and self-control are related to higher levels of well-being and lower levels of ill-being, thereby providing further insight into the theoretical framework of time perspectives during the COVID-19 pandemic. Additionally, our findings provide practical implications for psychological interventions during the on-going COVID-19 pandemic, focusing on the effects of time perspectives and self-control on the well-being and ill-being of different individuals.

Background

Time perspective (TP), which is a significant concept in social psychology, refers to the individual unconscious view and cognitive process into past, present, and future temporal frames [1], with the 'learned' character through the environment and situational forces [2, 3], which are of significant importance to well-being and distress [4]. Although there is a growing interest in TPs, the direct and indirect effects of TPs on well-being remain unclear [4, 5]. Additionally, studies on the changes in environment and their effects on TPs mainly involve small-scale studies or laboratory-based research [6, 7]. The COVID-19 pandemic, which occurred worldwide throughout 2020, has significantly impacted people's lives and mental health, thereby presenting an opportunity to explore the potential mediating role of TPs in mental health, especially regarding well-being and ill-being.

Based on the dual-factor system of mental health theory [8], this study mainly explores the impact of TPs on mental health during the COVID-19 pandemic by considering well-being and ill-being simultaneously. Additionally, the research gap is filled by explaining the mechanism underlying the impact of TPs on well-being and ill-being from the perspective of self-control. Furthermore, this study enriches the theoretical framework of TPs, especially the changes in TPs and the mediating role of TPs on mental health during the COVID-19 pandemic. This study also provides further insight into clinical practice and public health management during the pandemic from the perspective of TPs.

Perceived impact of COVID-19 on mental health

Based on the stress coping theory [9, 10], the perceived threat of external events, such as the COVID-19 pandemic, could result in maladaptive cognitions, which initiate coping responses and result in negative affectivity and mental health consequences [11–13]. However, the dual-factor system of mental health theories indicates that well-being (satisfaction with one's life and affect) and ill-being (the presence of psychological maladjustment) are separate factors of mental health [8]. To the best of our knowledge, there are limited studies exploring well-being and ill-being simultaneously. This study attempts to combine well-being and ill-being as mental health outcomes, and it investigates the role of the perceived impact of COVID-19 on mental health through the mediating roles of TPs and self-control.

Time perspectives and mental health during the COVID-19 pandemic

An individual's TP comprises their views on the past, present, and future. It represents a cognitive predilection towards a specific temporal condition [14], changes in the environment, stress, and culture [15], and it has a prominent influence on human ideology, feelings, and behaviours [5]. Individual TPs are divided into five categories [14]: past-positive (looking fondly on the past), past-negative (involves negative views on the past), present-fatalistic (involves the belief that life is out of one's control), present-hedonistic (an orientation on immediate impulses of pleasure), and future (considers the outcomes of actions and decisions) TPs. Different TPs have unique contributions to well-being and mental health [4]. Previous studies on the impacts of past-positive, past-negative, and present-fatalistic TPs on well-being are relatively consistent, and they are associated with long-term life changes, such as trauma [7, 16]. However, the present-hedonistic TP (PHTP) and the future TP (FTP), presenting the motivational process of pleasure seeking and long-term goals pursuing, respectively, often seem opposed to one another [14], and have attracted the attention of various researchers [2, 6, 17]. Additionally, the findings of research regarding the PHTP and the FTP are inconsistent. Individuals with the PHTP tend to experience a more positive affect [14]. However, this could harm their well-being by increasing risk-taking and aggressive behaviours [18]. Although, the FTP could be used as a predictor of a higher level of life satisfaction and increased subjective happiness [19], pursuing future goals may decrease enjoyment among individuals with such a TP [20]. Moreover, Holman & Grisham believe that the outbreak of COVID-19 significantly modified the way in which we perceive time and our futures [21]. Ogden demonstrated that people's experiences of time were significantly changed by the social and physical distancing measures enforced during the COVID-19 lockdown in the UK [22]. Based on the existing literature, and in the context of social isolation and mental disorders caused by COVID-19, we hypothesised that it would be significantly difficult for people to maintain a FTP and highly likely for them to choose a PHTP, thereby affecting their well-being and ill-being.

Relationship between time perspectives, self-control, and mental health

Self-control is considered an ability or a self-regulatory process that overrides undesired but cheerful impulses/actions to advance the realisation of distal goals [23], thereby contributing to the promotion of well-being [24, 25]. Self-control is highly associated with the PHTP and the FTP [14, 26]. Individuals with the PHTP have low levels of self-control, whereas those with the FTP have increased levels of perceived self-control [6, 17, 26]. Because of the close association between the PHTP, the FTP, and self-control, several studies have indicated that self-control mediates the effect of PHTP or FTP on mental health problems, including procrastination and internet addiction [6], and physical health (e.g. BMI) [27]. However, it remains unclear whether self-control served as a mediator between TPs and mental health during the outbreak of COVID-19.

Aims of this study

This study aims to formulate a theoretical model of the influence of TPs (e.g. PHTP and FTP) on mental health during the COVID-19 pandemic and clarify the mechanism through a structural equation model (SEM). Essentially, we hypothesised that the perceived impact of COVID-19 negatively predicts well-being and positively predicts ill-being through multiple mediations of the FTP, the PHTP, and self-control, as shown in Fig. 1.

Methods

Research design and sampling

This study was conducted from 30 April to 11 May, 2020, after the peak stage of the COVID-19 pandemic in China. At that time, the number of new local infections was 0–12 per day, but college students continued to take online classes at home. Data were collected from Chinese university students through the online survey platform 'Wenjuanxing' using simple cluster sampling via online questionnaires. A variety of electronic devices, such as laptops and smartphones, allowed for students to complete the questionnaires. Participants were required to complete all items before submitting, and to avoid data duplication, only one questionnaire could be completed from each IP address. All questionnaires were distributed by university teachers from 20 different universities, and compulsory questions involving university and major names were included in the questionnaires to ensure that all the participants were university students. One attention check question was added to screen valid questionnaires because incomplete answers were not allowed by the questionnaire program. Before the investigation, participants were notified of the aims and process of this study through an online notification. Each participant provided electronic written informed consent before participating in the survey.

Participants that did not meet the following criteria were excluded: (1) not Chinese students or not staying in mainland China during the COVID-19 pandemic, (2) students who were or had family members infected with COVID-19, and (3) students who failed the attention check question (e.g. 'Please choose the B option directly in this item').

Among 2,246 participants, 1,924 participants met the criteria, with a completion rate of 85.66%. The mean age was 19.58 years ($SD = 1.52$), ranging from 17 to 38 years of age; 704 (36.60%) were males; 820 (42.62%) were born in urban areas; 1347 (70%) were freshmen; and 714 (37.11%) majored in social science (see Table 1).

Table 1
Summary of sociodemographic characteristics (N= 1,924)

Variables	n (%)
Mean Age (SD)	19.58 (1.52)
Sex	
Male	704 (36.6%)
Female	1220 (63.4%)
Major	
Literature, Philosophy, Law, Education, History	714 (37.1%)
Economics, Management Science	446 (23.2%)
Science	135 (7.0%)
Engineering Science	441 (22.9%)
Art	147 (7.6%)
Physical Education	19 (1.0%)
Others (e.g., Medicine, Agriculture)	22 (1.1%)
Grade	
Freshmen	1347 (70%)
Sophomore	270 (14%)
Junior	207 (10.8%)
Senior and above	100 (5.2%)
Place of birth	
City	820 (42.6%)
Town	469 (24.4%)
Country	635 (33.0%)

Measures

Perceived impact of COVID-19

Participants were required to rate the extent to which their lives had been impacted by COVID-19 through six items, namely, study, application for employment/internship, examination, love, friendship, and entertainment and leisure (e.g. How much have your studies been impacted by COVID-19), using a 5-point scale (1 = large positive impact; 5 = large negative impact). Because it was a self-made scale, exploratory factor analysis (EFA) was used to extract two factors (learning and leisure), which accounted for 54.4% of the total variation. A two-factor confirmatory factor analysis (CFA) model indicated a good model fit ($\chi^2/df = 58.34$; comparative fit index (CFI) = 0.97; Tucker-Lewis index (TLI) = 0.95; root mean square error of approximation (RMSEA) = 0.08). The total score of the two dimensions generated a comprehensive grade of perceived impact ($\alpha = .80$), with higher grades showing a higher perceived negative impact of COVID-19.

Present-hedonistic and future time perspectives

Self-reported PHTP and FTP were evaluated using the Zimbardo Time Perspective Inventory (ZTPI) [14]. The Chinese version was validated, with Cronbach's $\alpha = .57 \sim .76$ [28], for 25 items. PHTP was measured using 4 items, for example, 'I do things impulsively'. FTP was measured using 5 items, for example, 'I complete projects on time by making steady progress'. Participants were asked to respond on a 5-point Likert scale (1 = 'very untrue of me', 5 = 'very true of me'). In our study, Cronbach's α was 0.81 for PHTP and 0.83 for FTP.

Self-control

The Self-Control Scale used in this study was prepared by Tangney et al.[29], and the Chinese version modified by Tan & Guo [30] is widely used (e.g. 'People can count on me to stay on schedule'). A 5-point scale ranging from 'Not at all' (1) to 'Very much so' (5) with five dimensions

of impulse control, healthy habits, temptation resisting, commitment, and moderate entertainment was used. The responses across the 19 items were summed, with higher scores indicating a higher tendency for self-control. In this study, Cronbach's α was 0.88.

Well-being

Well-being, especially hedonic happiness, includes pleasure, happiness, satisfaction with life [31], and the absence of negative affect [32]. In this study, we constructed the latent variable 'well-being' as an outcome variable based on life satisfaction and positive affect [33] because the absence of negative affect does not ensure that there are psychological assets [34].

The Satisfaction with Life Scale used in this study was compiled by Diener et al., [35]. Participant life satisfaction was assessed using the Chinese version [36]. It includes 5 items (e.g. 'in the majority of ways my life is close to my ideal') rated on a 7-point Likert scale (from 1 = 'strongly disagree' to 7 = 'strongly agree'). Cronbach's α was 0.82 in this study.

Positive affect was measured through the Positive and Negative Affect Scale (PANAS). The Positive Affect (PA) scale, which comprises 10 positive affect items (e.g. enthusiastic and inspired), was used in this study. Participants were required to rate each item on a 5-point Likert scale (from 1 = 'very slightly to not at all' to 5 = 'extremely') to rank the extent to which they felt the positive emotion over the previous two weeks. In this study, Cronbach's α was 0.92, with higher scores showing higher levels of positive emotions.

Ill-being

Ill-being comprises negative psychological conditions or characteristics. The latent variable 'ill-being' was constructed on the basis of anxiety and negative affect in this study [37].

Anxiety symptoms [38] were assessed using the Generalised Anxiety Disorder Scale (GAD-7). The Chinese version of the GAD-7 demonstrated good reliability (Cronbach's $\alpha = 0.89$) [39]. This version of the GAD-7 includes 7 items (e.g. 'Feeling nervous and anxious') that require the respondents to rate the frequency with which they experienced anxiety over the previous two weeks on a 4-point Likert scale (1 = 'not at all', 2 = 'some days', 3 = 'more than half the days', and 4 = 'almost every day'). In this study, Cronbach's α was 0.94. Higher grades indicate severe anxiety symptoms.

Negative Affect was also measured using the PANAS. The Negative Affect (NA) scale, which comprises 10 negative affect items (e.g. afraid and distressed), was derived from the PANAS [40]. In this study, Cronbach's α was 0.92, with higher grades showing a significant negative affect.

Data analysis

SPSS 24.0 and Mplus 8.0 were applied to organise and analyse the data. Descriptive statistics, Spearman correlation analyses, and SEM were used to examine the hypothesised multiple mediating effects. The criteria of goodness-of-fit parameters were $CFI \geq 0.90$, $TLI \geq 0.90$, $RMSEA \leq 0.08$, and standardized root mean square residual (SRMR) ≤ 0.08 [41]. The value of significance was 0.05 in this study. The mediation effect [42] was examined through bootstrapping, with 95% confidence intervals (CIs) in our analysis.

Results

Correlations between main variables

Table 2 shows the outcomes of the association among the main variables. The results showed that there were significant associations between well-being (e.g. life satisfaction and positive affect) and the perceived impacts of COVID-19 ($r = -0.19$; $r = -0.13$) on FTP ($r = 0.30$; $r = 0.37$), PHTP ($r = -0.15$; $r = -0.10$), and self-control ($r = 0.29$; $r = 0.23$). The associations between ill-being (e.g. anxiety and negative affect) and the perceived impacts of COVID-19 ($r = 0.20$; $r = 0.15$) on FTP ($r = -0.18$; $r = -0.25$), PHTP ($r = 0.38$; $r = 0.38$), and self-control ($r = -0.40$; $r = -0.42$) were also significant.

Table 2
Spearman correlations of measured variables (N= 1,924)

Variables	M± SD	1	2	3	4	5	6	7	8	9	10	11	12
1 Sex	1.63 ± 0.48	1											
2 Age	19.57 ± 1.58	– 0.09**	1										
3 Major	2.48 ± 1.50	– 0.40**	– 0.09**	1									
4 Place of birth	3.61 ± 1.28	–0.23	0.03	–0.01	1								
5 Grade	2.56 ± 1.02	–0.02	0.64**	– 0.10**	– 0.19**	1							
6 Perceived risk	21.44 ± 3.82	– 0.12**	0.14**	–0.01	0.11**	0.10**	1						
7 Future TP	17.53 ± 3.14	0.09**	0.05*	– 0.14**	– 0.08**	0.11**	– 0.07**	1					
8 Present-hedonistic TP	10.39 ± 3.04	0.03	–0.02	0.02	0.09**	– 0.06**	0.14**	– 0.23**	1				
9 Self-control	60.13 ± 10.73	–0.02	0.00	0.00	–0.04	0.03	– 0.19**	0.35**	– 0.65**	1			
10 Life satisfaction	19.83 ± 5.26	0.07	–0.14	–0.04	– 0.11**	0.04	– 0.19**	0.30**	– 0.15**	0.29**	1		
11 PANAS-PA	31.40 ± 6.58	–0.03	–0.02	–0.03	–0.09	0.02	– 0.13**	0.37**	– 0.10**	0.23**	0.45**	1	
12 Anxiety	11.98 ± 4.67	–0.04	0.03	0.03	0.01	0.06*	0.20**	– 0.18**	0.38**	– 0.40**	– 0.21**	– 0.20**	1
13 PANAS-NA	23.60 ± 8.51	– 0.08**	0.06**	0.06*	0.04	0.04	0.15**	– 0.25**	0.38**	– 0.42**	– 0.20**	– 0.17**	0.58**

Note. * $p < .05$, ** $p < .01$.

—Insert Table 2 here—

Multiple mediation analysis

First, the direct role of the perceived impact of COVID-19 on the latent variables of both well-being and ill-being was acceptable ($\chi^2/df = 1.04$, CFI = 1.00, TLI = 1.00, RMSEA = 0.01, SRMR = 0.01). The results showed that the perceived impact of COVID-19 had a direct negative prediction of well-being ($\beta = -0.25$, $p < 0.001$) and a positive prediction of ill-being ($\beta = 0.21$, $p < 0.001$). Second, as shown in Fig. 2, the mediating model was examined to test the indirect influence by constructing an SEM. Sex, age, major, place of birth, and grade were stipulated as covariates in the model. The model showing the various mediating effects conformed to the data well ($\chi^2/df = 7.71$, CFI = 0.97, TLI = 0.94, RMSEA = 0.05, SRMR = 0.04).

As shown in Table 3, increased perceived negative impacts of COVID-19 predicted lower well-being via three indirect paths through the FTP ($\beta = -0.04$, $p < 0.001$), PHTP ($\beta = 0.02$, $p < 0.01$), and self-control ($\beta = -0.03$, $p < 0.001$) separately, and two multiple indirect paths through the FTP and self-control ($\beta = -0.01$, $p < 0.01$) or the PHTP and self-control ($\beta = -0.03$, $p < 0.001$). Additionally, a higher perceived negative impact of COVID-19 positively predicted ill-being via two indirect paths through the PHTP ($\beta = 0.04$, $p < 0.001$) and self-control ($\beta = 0.03$, $p < 0.001$) and via two multiple indirect paths through the FTP and self-control ($\beta = 0.01$, $p < 0.01$) or the PHTP and self-control ($\beta = 0.03$, $p < 0.001$). Self-control acted as a chain mediation variable, completely mediating the variation from the FTP to ill-being. The total indirect effects explained 7.90% of the variance in well-being and 10.60% of the variance in ill-being.

Table 3
Standardized direct, indirect, and total effects for the mediation model ($N = 1,924$)

Model pathways	Standardized β	95% CI		p value
		Lower 5%	Upper 5%	
Well-being				
Direct effect	-0.25	-0.30	-0.20	0.000
Indirect effects	-0.08	-0.10	-0.06	0.000
PR→FTP→Well-being	-0.04	-0.05	-0.02	0.000
PR→PHTP→Well-being	0.02	0.01	0.03	0.002
PR→SC→Well-being	-0.03	-0.04	-0.02	0.000
PR→FTP→SC→Well-being	-0.01	-0.01	-0.00	0.001
PR→PHTP→SC→Well-being	-0.03	-0.04	-0.02	0.000
Ill-being				
Direct effect	0.21	0.16	0.25	0.000
Indirect effects	0.11	0.09	0.13	0.000
PR→FTP→Ill-being	0.00	0.00	0.01	0.126
PR→PHTP→Ill-being	0.04	0.03	0.05	0.000
PR→SC→Ill-being	0.03	0.02	0.04	0.000
PR→FTP→SC→Ill-being	0.01	0.00	0.01	0.002
PR→PHTP→SC→Ill-being	0.03	0.02	0.04	0.000

Note. PR: Perceived risk of COVID-19; FTP: Future time perspective; PHTP: Present-hedonistic time perspective; SC: Self-control.

Discussion

Our findings showed that a higher perceived negative impact of COVID-19 may be predicted as decreasing well-being and increasing ill-being. The association between the FTP or the PHTP and self-control further mediated the role of the perceived impact on mental health when well-being and ill-being were considered simultaneously. Specifically, the mediating effect of the FTP on ill-being was fully mediated by self-control.

Students who experienced significantly high impacts of COVID-19 reported higher levels of ill-being and lower levels of well-being. These results are consistent with those of previous studies during the outbreak stage of the COVID-19 pandemic [11, 43]. Our survey was conducted late into the outbreak of the COVID-19 pandemic in China. The low infection rate (daily infections below 20) does not mean that the changes COVID-19 has had on people's lives can be ignored. College students continue to experience the strain of the pandemic. Our results showed a tendency whereby individuals who self-reported being more impacted by COVID-19 were more likely to hold PHTPs and found it harder to maintain FTPs, thereby changing their levels of well-being. Although a causal explanation is difficult to derive from cross-sectional studies, the results are consistent with the findings of previous studies in that the COVID-19 pandemic has modified the way in which people perceive their future [21].

Considering the mediating effect of TPs on well-being, the PHTP demonstrated adaptability to well-being under the influence of the FTP and self-control model, consistent with the findings of previous studies [14]. Although these results are inconsistent with the findings of previous studies [20, 44], the FTP had a significant positive impact on well-being. A possible explanation is that during the on-going COVID-19 pandemic, focusing on the future may make people feel more hopeful and optimistic than ever before [45], which may significantly increase their levels of well-being.

Regarding the mediating effect of TPs on ill-being, only the PHTP had a significant effect. Unlike the findings of previous studies whereby individuals with FTPs experienced less negative affects [20], having an FTP may not reduce negative emotion and anxiety directly. One possible reason for this involves the context of COVID-19 in that when individuals are generally under stress, they experience more negative emotions than before. Another possible explanation is that well-being and ill-being are two different constructs contrary to two ends on a continuum [34]. Furthermore, we established that the FTP can positively predict well-being directly, but it negatively predicts ill-being through self-control.

Additionally, the results of this study demonstrated that self-control had a direct mediating effect on the perceived impact of COVID-19 on well-being and ill-being. Environmental changes may directly reduce self-control among individuals, thereby increasing the risks of ill-being and reducing the benefits of well-being. In our TP and self-control model, self-control was a crucial protective factor for well-being during the COVID-19 pandemic, and it functioned through a mediating mechanism, as demonstrated through our mediation model (well-being and ill-being), whose results differ from the findings of a previous study showing a moderating effect [46]. This result supported the motivational explanation of self-control [47]. We concluded that self-control is an option based on value and various internal cues, such as emotions, demands, and beliefs and various external cues, such as motivations, social pressure, and the environment.

Finally, the chain-mediated effects of TPs and self-control were significant, as they pertained to the perceived impacts of COVID-19 on well-being/ill-being. In the face of the negative impacts of the COVID-19 pandemic, the findings of this study indicated that the utility of emphasising only the FTP is limited. Therefore, the relationship between the FTP and self-control must be considered.

Implications

This study provides further insight and theoretical contributions. First, the results provided empirical evidence regarding the dual-factor system of mental health theory in which well-being and ill-being are two different structures, as opposed to two ends of one dimension. Owing to the COVID-19 pandemic, the way in which individuals perceive time and their futures [21] has been altered significantly, especially among college students who must take online classes at home. Having been removed from the campus environment, such students experience a conflict between 'striving for the future' or 'staying in the present' daily, which may affect their mental health. Second, contrary to the results of previous studies [45], the FTP provided additional positive emotions and increased levels of life satisfaction by following a direct path. There was no direct connection between the FTP and ill-being, thereby indicating that following an indirect path was significantly associated with ill-being. Additionally, the PHTP did not demonstrate a stable protection for mental health. Focusing on a PHTP had a positive effect on well-being, but it also increased ill-being, which requires additional consideration with regards to the context of the COVID-19 pandemic. Third, the relationship between the FTP or the PHTP and self-control has been proven and enriched. Therefore, through a multiple mediation model, this study provides a deeper understanding of the motivational interpretation rather than the ability-related interpretation of self-control, as it pertains to TPs. Specifically, the multiple mediating effects of the FTP and self-control have a significant impact on ill-being, thereby indicating that the association between the FTP and self-control has a high protective effect in the context of the current COVID-19 pandemic.

In addition to providing practical interpretations of the theories involved, this study provides further insight into clinical practice and public health management strategies associated with TPs. This study provides suggestions for ensuring the enhanced exertion of self-control in practical contexts. We believe that increased levels of self-control among students may be achieved by enhancing their FTPs to protect their mental health. Furthermore, excessive emphasis on the negative effects of COVID-19 may reduce self-control among college students, thereby harming their mental health. Therefore, in terms of policy publicity, emphasising future changes brought about by active pandemic prevention and showing confidence in the future may help individuals to increasingly comply with pandemic prevention policies and enhance their confidence.

Limitations and directions for future research

This study has several limitations. First, the cross-sectional design does not allow for conclusions regarding causation. Therefore, additional lab-based experiments are required in the future to manipulate participants' TPs in laboratory environments. Second, this study relied on convenience sampling, which may limit the generalisation of our findings beyond those involving college students. Third, based on the relationship between self-control and the influence of the COVID-19 pandemic on TPs, only the FTP and the PHTP were considered in the model. Other types of TPs could be included in future studies. Future studies could focus on exploring additional moderating variables, such as social support and personality factors, to better understand the influence of COVID-19 on mental health.

Conclusion

In conclusion, this study clearly demonstrates the association between TPs and self-control, as they pertain to mental health, especially well-being and ill-being, among college students. The FTP acted as a protective factor for well-being and was strongly recommended for college students throughout the duration of social isolation. The findings of this study enriched the theoretical framework of TPs and provided practical implications for ensuring mental health among individuals throughout the COVID-19 pandemic.

List Of Abbreviations

TP: time perspective; FTP: future time perspective; PHTP: present-hedonistic time perspective; SC: self-control; PA: positive affect; NA: negative affect

Declarations

Ethics approval and informed consent

This study was carried out in accordance with the Declaration of Helsinki. Electronic written informed consent was obtained from all participants before the survey. The research protocol (202011130050) was approved by the Research Ethics Review Committee of Beijing Normal University.

Consent for publication

Not applicable.

Availability of data

The datasets used during this research are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Authors' contributions

MZ and ZQ designed the study; MZ, YF and DD performed the analysis and interpreted the data; MZ and ZY gathered the data; MZ drafted the manuscript; YF revised the manuscript. All authors read and examined the final manuscript.

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References

1. Zimbardo, P.G. and J.N. Boyd, *Putting Time in Perspective: A Valid, Reliable Individual-Differences Metric*. Springer International Publishing, 2015.
2. Stolarski, M., J. Wojciechowski, and G. Matthews *Seeking the origins of time perspectives – Intelligence, temperament, or family environment? A one-year longitudinal study*. *Personality and Individual Differences*, 2021. **169**, DOI: 10.1016/j.paid.2020.110080.
3. Zimbardo, P. and B. John, *The Time Paradox: The New Psychology of Time That Will Change Your Life*. *time paradox the new psychology of time that can change your life*, 2008. **133**(12): p. 99–100.
4. Cunningham, K.F., J.W. Zhang, and R.T. Howell, *Time Perspectives and Subjective Well-Being: A Dual-Pathway Framework*, in *Time Perspective Theory; Review, Research and Application: Essays in Honor of Philip G. Zimbardo*, M. Stolarski, N. Fieulaine, and W. van Beek, Editors. 2015, Springer International Publishing: Cham. p. 403–415.
5. Burzynska, B. and M. Stolarski *Rethinking the Relationships Between Time Perspectives and Well-Being: Four Hypothetical Models Conceptualizing the Dynamic Interplay Between Temporal Framing and Mechanisms Boosting Mental Well-Being*. *Frontiers in Psychology*, 2020. **11**, DOI: 10.3389/fpsyg.2020.01033.
6. Kim, J., et al., *Effects of time perspective and self-control on procrastination and Internet addiction*. *Journal of Behavioral Addictions*, 2017. **6**(2): p. 229–236.
7. Tomich, P.L. and A. Tolich *Life is a balancing act: Deviation from a balanced time perspective mediates the relationship between lifetime trauma exposure and optimism*. *Current Psychology* 2019. DOI: 10.1007/s12144-019-00191-3.
8. Greenspoon, P.J. and D.H. Saklofske, *Toward an Integration of Subjective Well-Being and Psychopathology*. *Social Indicators Research*, 2001. **54**(1): p. 81–108.

9. Lazarus, R.S., *Evolution of a model of stress, coping, and discrete emotions.*, in *Handbook of stress, coping, and health: Implications for nursing research, theory, and practice* V.H. Rice, Editor. 2000, Sage: Thousand Oaks, CA. p. 195–222.
10. Lazarus, R.S. and S. Folkman, *Stress, appraisal, and coping*. 1984, New York: Springer.
11. Feng, Y., et al. *When altruists cannot help: the influence of altruism on the mental health of university students during the COVID-19 pandemic*. *Global Health*, 2020. **16**, DOI: 10.1186/s12992-020-00587-y.
12. Fulham, L., et al., *The Effect of Hypervigilance on the Relationship Between Sexual Victimization and Gait*. *Journal of Interpersonal Violence*, 2020. **35**(19–20): p. 4061–4082.
13. Isiekwe, I.G., et al., *Perceived impact of the COVID-19 pandemic on orthodontic practice by orthodontists and orthodontic residents in Nigeria*. *Journal of the World Federation of Orthodontists*, 2020. **9**(3): p. 123–128.
14. Zimbardo, P.G. and J.N. Boyd, *Putting time in perspective: A valid, reliable individual differences metric*. *Journal of Personality and Social Psychology*, 1999. **77**(6): p. 1271–1288.
15. Fong, G. and P. Hall, *Time perspective: a potentially important construct for decreasing health risk behaviors among adolescents*, in *Reducing Adolescent Risk: Toward an Integrated Approach*, D. Romer, Editor. 2003, SAGE Publications, Inc.: Thousand Oaks, CA. p. 106–112.
16. Stolarski, M. and G. Matthews, *Time Perspectives Predict Mood States and Satisfaction with Life over and above Personality*. *Current Psychology*, 2016. **35**(4): p. 516–526.
17. Dreves, P.A. and G.C. Blackhart, *Thinking into the future: how a future time perspective improves self-control*. *Personality and Individual Differences*, 2019. **149**: p. 141–151.
18. Hutton, H., G. Treisman, and W. Hunt, *HIV risk behaviors and their relationship to posttraumatic stress disorder among women prisoners*. *Psychiatric Services*, 2001. **52**(4): p. 508–513.
19. Kooij, D.T.A.M., et al., *Future Time Perspective: A Systematic Review and Meta-Analysis*. *Journal of Applied Psychology*, 2018. **103**(8): p. 867–893.
20. Zhang, J.W., R.T. Howell, and T. Bowerman, *Validating a brief measure of the Zimbardo time perspective inventory*. *Time and Society*, 2013. **22**: p. 391–409.
21. Holman, E.A. and E.L. Grisham, *When time falls apart: The public health implications of distorted time perception in the age of COVID-19*. *Psychological Trauma: Theory, Research, Practice, and Policy*, 2020. **12**(S1): p. S63-S65.
22. Ogden, R.S. *The passage of time during the UK Covid-19 lockdown*. *PLoS One*, 2020. **15**, DOI: 10.1371/journal.pone.0235871.
23. Baumeister, R.F., K.D. Vohs, and D.M. Tice, *The strength model of self-control*. *Current Directions in Psychological Science*, 2007. **16**(6): p. 351–355.
24. Dou, K., et al. *Engaging in prosocial behavior explains how high self-control relates to more life satisfaction: Evidence from three Chinese samples*. *PLoS One*, 2019. **14**, DOI: 10.1371/journal.pone.0223169.
25. Wiese, C.W., et al., *Too much of a good thing? Exploring the inverted-U relationship between self-control and happiness*. *Journal of Personality*, 2018. **86**(3): p. 380–396.
26. Barber, L., et al., *When does time perspective matter? Self-control as a moderator between time perspective and academic achievement*. *Personality and Individual Differences*, 2009. **46**(2): p. 250–253.
27. Price, M., S. Higgs, and M. Lee, *Self-control mediates the relationship between time perspective and BMI*. *Appetite*, 2017. **108**: p. 156–160.
28. Wang, C., *Time Perspective: The revision of the inventory and the influence on risky driving behavior*, in *Applied Psychology*. 2006, Southwest University: Chong Qing. p. 42.
29. Tangney, J.P., R.F. Baumeister, and A.L. Boone, *High Self-Control Predicts Good Adjustment, Less Pathology, Better Grades, and Interpersonal Success*. *Journal of Personality* 2004. **72**(2): p. 271–322.
30. Tan, S.-H. and Y.-Y. Guo, *Revision of Self-Control Scale for Chinese college students*. *Chinese Journal of Clinical Psychology*, 2008. **16**: p. 468–470.
31. Deci, E.L. and R.M. Ryan *Hedonia, eudaimonia, and well-being: An introduction*. *Journal of Happiness Studies*, 2008. **9**, DOI: 10.1007/s10902-006-9018-1.
32. Keyes, C.L., D. Shmotkin, and C.D. Ryff, *Optimizing well-being: The empirical encounter of two traditions*. *Journal of Personality and Social Psychology*, 2002. **82**(6): p. 1007–1022.
33. Chang, E.C., et al. *Beyond the role of loneliness in psychological ill-being and well-being in females: Do social problem-solving processes still matter?* *Personality and Individual Differences*, 2020. **155**, DOI: 10.1016/j.paid.2019.109729.
34. Hernandez, R., et al., *Psychological Well-Being and Physical Health: Associations, Mechanisms, and Future Directions*. *Emotion Review*, 2018. **10**(1): p. 18–29.

35. Diener, E., et al., *The Satisfaction with Life Scale*. Journal of Personality Assessment, 1985. **49**: p. 71–75.
36. Wang, K.T., M. Yuen, and R.B. Slaney, *Perfectionism, depression, loneliness, and life satisfaction: A study of high school students in Hong Kong*. The Counseling Psychologist, 2009. **37**(2): p. 249–274.
37. Liu, J., K. Bartholomew, and P.-K. Chung, *Perceptions of Teachers' Interpersonal Styles and Well-Being and Ill-Being in Secondary School Physical Education Students: The Role of Need Satisfaction and Need Frustration*. School Mental Health, 2017. **9**(4): p. 360–371.
38. Spitzer, R.L., et al., *A brief measure for assessing generalized anxiety disorder: the GAD-7*. Archives of Internal Medicine 2006. **166**(10): p. 1092–1097.
39. Tong, X., et al., *Validation of the generalized anxiety Disorder-7 (GAD-7) among Chinese people with epilepsy*. Epilepsy Research, 2016. **120**: p. 31–36.
40. Watson, D., L.A. Clark, and A. Tellegen, *Development and validation of brief measures of positive and negative affect: the PANAS scales*. Journal of Personality and Social Psychology, 1988. **54**(6): p. 1063–1070.
41. Wen, Z., K. Hau, and W.M. Herbert, *Structural equation model Testing: Cutoff criteria for goodness of fit indices and Chi-square test*. Acta Psychologica Sinica, 2004. **36**(2): p. 186–194.
42. Preacher, K.J. and A.F. Hayes, *Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models*. Behavior Research Methods, 2008. **40**: p. 879–891.
43. Pedrozo-Pupo, J.C., M.J. Pedrozo-Cortés, and A. Campo-Arias *Perceived stress associated with COVID-19 epidemic in Colombia: an online survey*. Cadernos de Saúde Pública, 2020. **36**, DOI: 10.1590/0102-311X00090520.
44. Zhang, J.W. and R.T. Howell, *Do time perspectives predict unique variance in life satisfaction beyond personality traits?*. Personality and Individual Differences, 2011. **50**(8): p. 1261–1266.
45. Boniwell, I., et al., *A question of balance: Time perspective and well-being in British and Russian samples*. The Journal of Positive Psychology, 2010. **5**(1): p. 24–40.
46. Li, J.-B., et al. *Self-Control Moderates the Association Between Perceived Severity of Coronavirus Disease 2019 (COVID-19) and Mental Health Problems Among the Chinese Public*. International Journal of Environmental Research and Public Health, 2020. **17**, DOI: 10.3390/ijerph17134820.
47. Grund, A. and C.-A. Carstens, *Self-control motivationally reconsidered: "Acting" self-controlled is different to "being good" at self-control*. Motivation and Emotion, 2019. **43**(1): p. 63–81.

Figures

Figure 1

The hypothesised model

Note. The plus and minus signs present the positive and negative predictive effects of the pathways, respectively.

Figure 2

The final structural equation model

Note. The solid lines represent significant predictive effects. The dashed line shows that the predictive effects were insignificant: *** $p < .001$.