How health anxiety affected obsessive-compulsive symptoms during the COVID-19 pandemic in China: The mediation of difficulties in emotion regulation and the moderation of pathological personality traits

Danping Hong [a], Yawen Zhu [b], Meng Yu [c,*]

[a] School of Psychology, South China Normal University, Guangzhou 510631, PR China
[b] Key Laboratory of behavioral and mental health of Gansu Province, School of Psychology, Northwest Normal University, Lanzhou 730070, PR China
[c] Guangdong Provincial Key Laboratory of Social Cognitive Neuroscience and Mental Health, Department of Psychology, Sun Yat-Sen University, Guangzhou 510006, PR China

ARTICLE INFO

ABSTRACT

Health anxiety (HA) was/is a common negative emotional problem during the COVID-19 pandemic. According to the cognitive model of HA, individuals with HA continued to adopt a series of maladaptive and repetitive behaviors which were associated with obsessive-compulsive symptoms (OCS; including over-washing, over-checking, obsessing, and metal neutralizing). The priority of the present study was to explore how HA specifically affected OCS and whether difficulties in emotion regulation (DER) and pathological personality traits (PPT) affected the relationship between the HA and OCS. We distributed an online survey from February 1 to February 17 in 2020 ($N = 1546$, with average age of 25.8, and 32.7% of males) from 219 cities in China. Results showed that only four dimensions (i.e., Nonacceptance, Impulse, Non-clarity and Non-awareness) of the DER scale mediated in the predictive path of HA on OCS, which constituted a multiple mediating model. The other moderated mediation model further showed that, with higher PPT, the more significant the impact of HA was on DER, revealing PPT's moderator role between HA and OCS.

1. Introduction

Coronavirus Disease of 2019 (COVID-19) pandemic had been listed as a public health emergency of international concern since its outbreak on January 30, 2020 (World Health Organization, 2020). As of January 31, 2020, China's epidemic had infected more than 31 provinces, with 259 deaths and 1795 severe cases, and it was still increasing (National Health Commission of the People's Republic of China, 2020). Chinese public responded to the government's policy to reduce going out and lockdown at home (National Health Commission of the People's Republic of China, 2020). Accompanied with actually real threatened stimuli, part of people tended to overestimate the possibility of getting infected as well, resulting in health anxiety. Moreover, some standard social norms have been promoted during the epidemic, such as hands-washing, temperature-checking, and disinfecting. Therefore, the present study aimed to investigate whether individuals with health anxiety tend to adopt these behaviors that might develop obsessive-compulsive symptoms.

1.1. The relationship between health anxiety and obsessive-compulsive symptoms

Health Anxiety (HA) refers to the tendency to negatively explain both usual and unusual physical sensations (e.g., rapid heartbeat) or symptoms (e.g., sore throat), and to overpay attention to and worry about their physical health, thus producing stressful experiences (Salkovskis & Warwick, 1986). Researchers (Salkovskis et al., 1986; Taylor & Asmundson, 2004) developed an integrated model of HA based on cognitive behavioral therapy (CBT). This model demonstrated that if an individual has potential distorted cognitions about the physical feelings, those cognitions would be easily activated by different events, such as, the spread of COVID-19-related news and changes in own somatosensory. Then, these feelings would be explained catastrophically, triggering HA (Taylor & Asmundson, 2004). In particular, they had vague standards for confirmed infections of COVID-19, including medical symptoms, i.e., fever, cough, difficulty breathing (Chen et al., 2020). However, due to isolation during acute phrase at the beginning of the

---

epidemic, ordinary people could not go to the hospital for treatment, and thus could not verify whether they were infected.

Furthermore, Yin et al. (2020) later proposed a COVID-19-related model in China. They claimed that, maintaining a high level of vigilance on COVID-19-related information would activate individuals' distorted belief about HA. Driven by HA, intrusive thoughts arose, which would prompt some stressful feelings and compulsive behaviors to reduce the risk of being infected, such as, repetitive temperature-checking or wearing the mask (Wang et al., 2020). By using these maladaptive and repetitive coping strategies, they prevented the disconfirmation of negative beliefs and temporarily relieved the pain, however, actually promoting the formation of Obsessive-compulsive symptoms (Fergus & Bardeen, 2014).

Obsessive-compulsive symptom(s) (OCS) is featured with obsessive thinking and compulsive behaviors (e.g., over-washing and -checking) (DSM-5; American Psychiatric Association, 2013). Calkins et al., 2013 established a cognitive model of obsessive-compulsive (OC) disorder. This model suggested that intrusive thoughts are morally offensive or may cause real harm. Therefore, not accepting results in an increase in anxiety. As mentioned before, maladaptive and repetitive coping strategies were used to temporarily calm the anxiety but actually maintained the OCS in the long run. Previous studies, statistically, have shown that HA can significantly encourage OCS (Sunderland et al., 2013). However, some issues are not apparent yet. First, during the COVID-19 pandemic, the mechanism of how HA affect the OCS is still unclear. Second, although some separate discussions about HA and OCS in the Chinese sample, there is still a lack of research on their relationship.

1.2. The mediating effect of difficulties in emotion regulation

When facing the sudden outbreak of epidemic, the public needs effective emotion regulation strategies. Individuals with HA were prone to generate negative emotions and to take short-term effective but maladaptive coping strategies (Görgen et al., 2014). Difficulties in Emotion Regulation (DER) is defined as the imbalance in adjusting one's emotions, and relates to repeated efforts to avoid emotional experiences (Gratz, & Roemer, 2008). DER was viewed as a multi-dimensional structure (Gratz & Roemer, 2004). Via DER, the influence of HA on OCS was further promoted (Görgen et al., 2014). Furthermore, all dimensions of DER could directly affect OCS and predict the severity of OCS (Fergus & Bardeen, 2014; Yap et al., 2018). On the basis of the above-mentioned conceptual and empirical work, we explored the impact of six DER dimensions on the association between HA and OCS.

1.3. The moderating effect of pathological personality traits

Pathological Personality Traits (PPT) is a stable personality tendency, which is mainly manifested in poor adaptation (DSM-5; American Psychiatric Association, 2013). Research has shown that PPT could explain the relation with comorbid problems such as anxiety and emotion disorders (Krueger et al., 2012). Empirically, Pollock et al. (2016) recruited 932 undergraduates and results showed that DER was closely related to all dimensions of PPT, and individuals who have experienced negative events difficulty regulating their emotions. It's noteworthy that individuals with severer PPT reported poorer psychological endurance, and it's more challenging for them to adapt to the external environment. This internal and external imbalance will further strengthen the original negative personality tendency and move in an irreversible direction. Therefore, we hypothesized that PPT might play moderating role in the pathway of HA to DER.

1.4. The present study

To sum up, based on the cognitive model and the COVID-19 background, we mainly examined how HA affects OCS. Our research built a

multiple mediating model and a moderated mediation model to comprehensively consider the mediating of DER and the moderation of PPT. It is possible that our study enriches the research of HA on OCS with Chinese samples and helps us make targeted suggestions for mitigation.

2. Methods

2.1. Participants

The present study was approved by corresponding author's affiliation ethics committee. Wenjuanxing platform (https://www.wjx.cn/) was used to conduct an online survey. The questionnaire package was distributed from February 1 to February 17, 2020 in China. All participants were voluntarily recruited. Finally, a total data of 1612 answers were collected, of which 1546 were valid, and the effective response rate was 95.91%. The three section criteria would be found in Supplementary material and no outliers were found. As for the setting that the answer to questionnaires with missing data would not be submitted successfully, hence, no missing data existed. There were 506 males and 1040 females aged from 18 to 64 years ($M = 25.78$, $SD = 9.29$). Moreover, 79.69% of people have a college degree, and 76.5% of participants have a monthly income of less than 15,000 RMB. It covered 219 cities, of which 43.02% were from areas with the severe and extremely severe epidemic at the current time. The division standard of the areas and other detailed demographic information is shown in Table 1 in Supplementary material.

2.2. Measures

2.2.1. Short health anxiety inventory (SHAI)

The SHAI contains 18 items (e.g., "*I am worried about my health*") (Salkovskis et al., 2002). Zhang et al. (2015) revised the Chinese version of SHAI with good psychometric properties. Each item consists of 4 statements ranging from 0 (*I do not*) to 3 (*I spend most of my time*). In the present study, the α coefficient was 0.79.

2.2.2. The obsessive-compulsive inventory-revised (OCI-R)

The Obsessive-Compulsive Inventory (OCI) was consisted of 18 questions and six factors (Foa et al., 1998). OCI was later revised by Tang et al. (2011) as OCI-R in Chinese college students with good psychometric properties. OCI-R is a five-point score from 0 (*not at all*) to 4 (*extremely*). Four dimensions applicable to the epidemic situation were chose: obsessing (e.g., "*I often have thoughts about getting infect in my mind*"), checking (e.g., "*I repeatedly touched my forehead to check if I have a fever*"), washing (e.g., "*I often spray alcohol for disinfection*"), and mental neutralizing (e.g., "*Even after taking sufficient protective measures, I still worry that be infected*"). Several wording adaptations were made in terms of sentences, more matched in the context of the epidemic situation. The Cronbach's alpha was 0.90 for the total score.

2.2.3. The Difficulties in Emotion Regulation Scale (DERS)

DERS was developed to measure adults' emotion dysregulation (Gratz & Roemer, 2004). The Chinese version of DERS contains 32 items with good reliability and validity (Li et al., 2018). All items are rated on a 5-point Likert scale ranging from 1 (*totally disagree*) to 5 (*totally agree*). According to the COVID-19-related situation, items were changed from, e.g., "*When I'm upset*" to "*When I feel pressure due to the epidemic*" and the original 13th item ("*When I'm upset, I have difficulty getting work done*") was removed. The CFA results showed a well-fit model ($x^2/df = 7.846$, CFI = 0.916, TLI = 0.905, RMSEA = 0.066) (Hoyle, 2012). It included six dimensions named as follows: difficulties in engaging directed behavior (Goals, e.g., "*When I feel pressure due to the epidemic, I have difficulty concentrating*"), limited access to emotional regulation strategies (Strategies, e.g., "*When I feel pressure due to the epidemic, it takes me a long time to feel better*"), nonacceptance of emotional responses (Nonacceptance, e.g., "*When I feel pressure due to the epidemic, I feel guilty*

for feeling that way"), difficulties in controlling impulsive behaviors under negative emotions (Impulse, e.g., *"When I feel pressure due to the epidemic, I lose control over my behaviors"*), lack of emotional clarify (Non-clarity,[1] e.g., *"I have difficulty making sense out of my feelings"*), and lack of emotional awareness (Non-awareness,[2] e.g., *"I pay attention to how I feel"*). The total Cronbach's alpha for the total score was 0.90, and 0.88, 0.81, 0.76, 0.89, 0.68, 0.77 for each subscale, respectively.

2.2.4. The Personality Inventory for DSM-5-Brief Form (PID-5-BF)

The Personality Inventory for DSM-5 (PID-5) was compiled according to the multidimensional PPT in DSM-5 evaluation criteria B (Krueger et al., 2012). It assesses five pathological personality traits, including negative effects, disinhibition, detachment, psychoticism, antagonism. The PID-5-BF extracted topics for each dimension based on PID-5 and five items for each trait domain (Anderson, Sellbom, & Salekin, 2018). The Chinese version of PID-5-BF was translated by a Chinese Project team,[3] which has gotten official authorization from APA (see more details in Zhang et al., 2021). It is rated on a 4-point scale, from 0 (*very false or often false*) to 3 (*very true or often true*). The total Cronbach's alpha was 0.92. In February 2020, when we collected data, PID-5-BF has not been psychometrically testing in Chinese samples. Hence, we did a CFA for the structure validity for PID-5-BF with a well-fit model (Hoyle, 2012): $x^2/df = 2.637$, CFI $= 0.914$, TLI $= 0.903$, RMSEA $= 0.033$, SRMR $= 0.052$.

2.3. Statistical analyses

Firstly, the Cronbach's alpha and CFA of the scales were calculated by Mplus 8.3. Then, IBM SPSS Statistics 22.0 was used to describe samples' descriptive statistics and the Pearson correlation coefficient. Besides, the PROCESS macro (Hayes, 2017) was conducted for analyzing multiple mediating and moderated mediation effects, which adopted the non-parametric percentile Bootstrap method (Erceg-Hurn & Mirosevich, 2008).

3. Results

3.1. The correlations among variables

Table 1 presents the correlation coefficients among variables. Results showed that the total HA, DER, PPT, and OCS scores were significantly inter-correlated ($r = 0.296$–0.497). All DER dimensions are positively correlated with other variables. Only Non-awareness was not significantly related with PPT and displayed a relatively low negative correlations with HA and OCS.

3.2. Multi-mediation model tests

Data was standardized first. Taking HA as independent variable (X), OCS as dependent variable (Y), Goals (M_1), Strategies (M_2), Nonacceptance (M_3), Impulse (M_4), Non-clarity (M_5), Non-awareness (M_6) as mediating variables, age, occupation, physical conditions, and current residence as covariate variables, a multiple mediating model was constructed. The model showed well-fitting indexes as: $x^2/df = 7.258$, CFI

---

[1] Gratz and Roemer (2004) used "Clarity" as the abbreviation for this dimension, but to avoid ambiguity, it was changed to "Non-clarity" in the present study. They express the same meaning.

[2] Same as the previous one, using "Non-awareness" instead of Awareness.

[3] This Project team lead by Professor Wang, J. from Beijing Normal University and Professor Zhong, J. from Peking University in China. This team spent three years translating all DSM-5 online measurements in Chinese, including the procedure of independent translation, back-translation, controversial-items-checking and -double-discussing, finally approved according to the similarity with original items the consensus among experts.

$= 0.989$, TLI $= 0.957$, RMSEA $= 0.064$, SRMR $= 0.022$. As expected, HA was significant for all dimension of DER in the predictive pathways. However, the pathway of HA to Non-awareness showed marginal significance ($\beta = -0.052$, $SE = 0.026$, $p = .041$). In addition, Goals and Strategies were not the significant predictors of OCS. See Fig. 1.

The direct effect was 0.396 with effect size of 77.52% ($SE = 0.024$, 95%CI [0.35,0.44]). And the indirect effect was 0.115 with effect size of 22.48% ($SE = 0.017$, 95%CI [0.08,0.015]). Specifically, the 95%CI of the three paths X-M_1-Y, X-M_2—Y contained 0, indicating non-significant mediation effects. The 95%CI of pathways, X-M_3-Y, X-M_4-Y, X-M_5-Y and X-M_6-Y did not contain 0, displaying significant mediating effects between HA and OCS with effect size of 12.59%, −9.34%, 4.95% and 0.90% of the total effect, separately. The mediation effect of X-M_3 (Nonacceptance)-Y was negative. See Table 2 in Supplementary material for more information.

3.3. Moderated mediating effect

Data were first standardized. Age, occupation, physical condition and current residence, subjective assessment of the severity of epidemic spread and individual stress during the pandemic spread were controlled as covariables. In this model, HA was the independent variable (X), OCS as the dependent variable (Y), the total score of DER as the mediator (M), and the level of PPT as the moderator (W).

As shown in Table 2, Equation 1 was significant, $F(9,1536) = 88.367$, $p < .001$, $R^2 = 0.341$. HA significantly and positively predicted OCS ($\beta = 0.378$, $SE = 0.025$, 95%CI [0.33, 0.43]) and the interaction term of HA and PPT had no significant effect on OCS. Equation 2 displayed at a significant level, $F(9,1536) = 79.747$, $p < .001$, $R^2 = 0.320$. Among which, HA significantly impacted on DER ($\beta = 0.150$, $SE = 0.026$, 95%CI [0.10, 0.20]), and the product term of HA and PPT showed a significant influence on DER ($\beta = 0.100$, $SE = 0.016$, 95%CI [0.07, 0.13]). Equation 3 demonstrated a significant result ($F(11,1534) = 73.791$, $p < .001$, $R^2 = 0.346$), HA significantly and positively predicted OCS ($\beta = 0.366$, $SE = 0.026$, 95%CI [0.32, 0.42]), DER was a significant and positive predictor of OCS ($\beta = 0.081$, $SE = 0.026$, 95%CI [0.03, 0.13]). To sum up, DER played a mediating role between HA and OCS, while PPT regulated the first half of the pathway.

To further reveal the interaction effect, a simple slope test was performed (Dearing & Hamilton, 2006). As shown in Fig. 2, results found that HA could significantly predict DER when evaluating PPT at above ($\beta_{positive} = 0.249$, $SE = 0.027$, $p < .001$, 95% CI [0.20, 0.30]) but not at below ($\beta_{negative} = 0.052$, $SE = 0.034$, $p = .123$, 95% CI [−0.01, 0.12]) one standard deviation.

4. Discussion

4.1. The multiple mediation model

In general, results found that: (a) scores on HA, OCS and the six dimensions of DER all showed a significant positive intercorrelation, separately; (b) four dimensions of DER was, respectively, shown to be the mediator in the pathway of HA affecting OCS, which constituted a multiple mediation model.

The current study is reflected in the 0.396 of the direct effect, 77.52% effect size of HA to OCS. This is quite a large proportion of the total effect emphasizing HA's influence on OCS. In addition, as a supplement, we also asked participants to write down their repetitive behaviors related to the epidemic and the repetition frequency. As a result, the most frequently mentioned behavior was the constant phone-checking for epidemic-related information, which is consistent with existed research (Wang et al., 2020).

Findings demonstrated that HA had a significant effect on the six dimensions of DER, which is mainly consistent with the previous-mentioned results. However, two dimensions, Goals and Strategies, was not a significant predictor of OCS. In February 2020, that the control

Table 1

Pearson's correlation coefficient of variables ($N = 1546$).

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10
1. HA	–									
2. DER	0.392***	–								
3. Goals	0.410***	0.806***	–							
4. Strategies	0.451***	0.879***	0.787***	–						
5. Nonacceptance	0.311***	0.739***	0.552***	0.680***	–					
6. Impulse	0.380***	0.880***	0.764***	0.833***	0.670***	–				
7. Non-clarity	0.327***	0.719***	0.471***	0.532***	0.464***	0.576***	–			
8. Non-awareness	−0.056*	0.443***	0.102***	0.113***	0.057*	0.146***	0.295***	–		
9. PPT	0.447***	0.389***	0.321***	0.402***	0.295***	0.348***	0.392***	0.035	–	
10. OCS	0.497***	0.349***	0.344***	0.388***	0.374***	0.324***	0.288***	−0.072**	0.296***	–
Mean	0.638	1.779	1.751	1.575	1.357	1.484	1.721	2.908	0.780	1.301
SD	0.378	0.482	0.718	0.609	0.568	0.565	0.632	0.887	0.493	0.722

Note. HA, DER, PPT, and OCS are shorthand for Health Anxiety, Difficulties in Emotion Regulation, Pathological Personality Traits and Obsessive-compulsive Symptoms.

* $p < .05$.
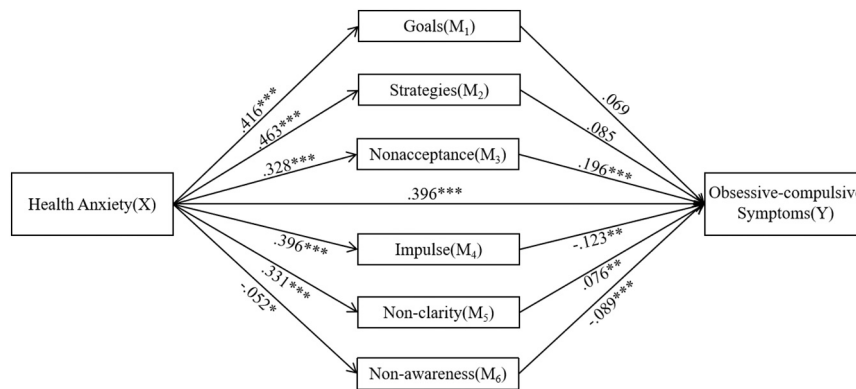** $p < .01$.
*** $p < .001$.

Fig. 1. The mediating effect of six dimensions of DER on the relation between HA and OCS.

Table 2

The moderated mediating effect test of HA on OCS.

	Equation 1: OCS(Y)			Equation 2: DER(M)			Equation 3: OCS(Y)		
	β	SE	95%CI	β	SE	95%CI	β	SE	95%CI
HA(X)	0.378***	0.025	[0.33, 0.43]	0.150***	0.026	[0.10, 0.20]	0.366***	0.026	[0.32, 0.42]
PPT(W)	0.055*	0.024	[0.01, 0.10]	0.220***	0.024	[0.17, 0.27]	0.035	0.024	[−0.01, 0.08]
HA*PPT(X*W)	−0.007	0.016	[−0.4, 0.03]	0.100***	0.016	[0.07, 0.13]	−0.020	0.019	[−0.06, 0.02]
DER(M)							0.081**	0.026	[0.03, 0.13]
DER*PPT(M*W)							0.011	0.021	[−0.03, 0.05]
R^2	0.341			0.320			0.346		
F	88.367***			79.747***			73.791***		

* $p < .05$.
** $p < .01$.
*** $p < .001$.

of the epidemic in China was very stringent made most of the public be isolated at home with a complete shutdown of work and school (China National Health Commission, 2020). Such an isolation environment made it difficult to quickly form an effective emotional coping strategy. Hence, within this context, it's understandable that Goals and Strategies were not predictable of OCS. Next, we would like to present the four significant indirect pathways of DER between HA and OCS as follows.

4.1.1. Nonacceptance

Results showed that it made up the largest percentage (12.59%) of the total mediation effect, revealing the importance role of HA in affecting OCS. Inconsistent with previous studies, results suggested that, when anxious about health, people were inclined to get rid of the

negative emotional reactions rather than accept (Bardeen & Fergus, 2014). However, thus nonacceptance may further deepen the formation of OCS (Fergus & Bardeen, 2014). Moreover, studies found that accepting unwanted emotions can better help OC patients release from obsessive-compulsive symptoms (de la Cruz et al., 2013).

4.1.2. Impulse

HA could contribute to the generation of OCS via impulse with effect size of −9.34%. However, the path coefficient of impulse on OCS was shown to be negative. This is uncommon, but still could be understandable. Previous research has demonstrated that with a general sense of perceivable out-of-control, OC patients always used repetitive compulsive behaviors to gain a sense of security (Moulding & Kyrios,
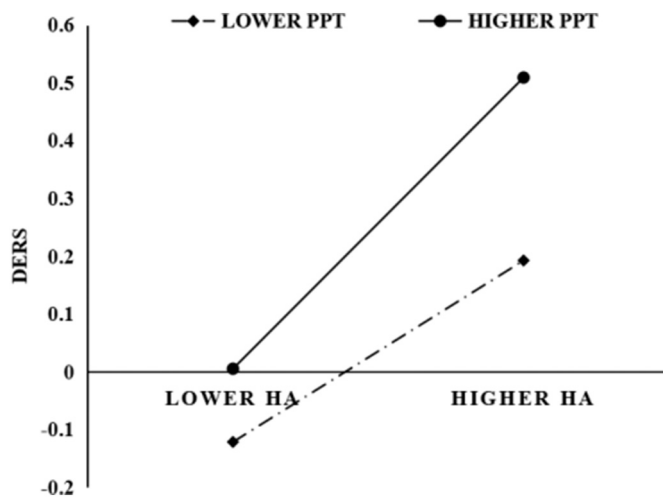
Fig. 2. The Moderating effect of PPT on the relationship between HA and DER.

2006). Hence, the out-of-control seemed to facilitate OCS. However, most normal people psychologically and environmentally affected by the COVID-19 pandemic reminded us that not only repetitive behaviors could provide them with sufficient security. During home quarantine, the impulse may be an advantage to get attention from others. This actually made people reduce repetitive and ruminative tendency.

4.1.3. Non-clarity

The mediation effect size was 4.95%. The uncontrollable and unpredictable situation might increase individuals' anxiety and panic. Over time, these aggravated and ambiguous negative emotions would not disappear out of thin air. In turn, to lessen exaggerated negative physical sensations, repetitive actions (e.g., checking) would ensure a momentary sense of safety for them (Calkins et al., 2013). As one of the essential techniques of CBT, the priority was to recognize one's (both negative and positive) feelings (Berking et al., 2008).

4.1.4. Non-awareness

The mediation effect size was small (0.90%) but significant. Specifically, the increase of HA would improve individuals' awareness of their own feelings, which was consistent with Bardeen and Fergus (2014). They claimed that *"the combination of higher emotional awareness with lower emotional clarity may be associated with higher levels of health worry"*. Namely, individuals with higher HA paid more attention to but also misunderstood their own emotions (Bardeen et al., 2013). However, this showed kinda paradox with the situation in Non-clarity. We postulated that during the pandemic, when reporting to what extent they would pay attention to their feelings, those feelings might include a part of physical sensations which were alarming and sematic signals. Moreover, as the predecessors found out, that the psychometric limitation of this dimension (i.e., not significantly correlated with other five dimensions of DER) (e.g., Bardeen et al., 2013) made it a bit unstable in the application. Therefore, strengthening awareness towards one's feelings is not necessarily beneficial for alleviating individuals' negative reactions.

4.2. The moderated mediation model

As postulated, we verified that, for those with higher level of pathological personality traits, their level of health anxiety showed a greater impact on DER.

DER has been proven to be related to a wide range of psychopathological symptoms and maladaptive behaviors (e.g., Yap et al., 2018). Individuals with higher level of PPT were poorer in dealing with strong external stimulus (Putnam & Silk, 2005), making them not successfully eliminate the multiple negative emotions produced by the sudden

outbreak threat. Individuals with such characteristics tended to treat the impact of the epidemic in a more negative, pessimistic and extreme way (Harkness et al., 2014). To cope with the negative experiences, they were more likely to take maladaptive actions to briefly release from being concerned about health (Görgen et al., 2014). Indeed, with high level of pathological personality traits, they chose the automatic and easily-operated emotion regulation strategies, like avoiding, denying and suppressing emotions, making the influence of HA on DER even stronger. Therefore, strengthening the assessment of personality traits would be necessary to conduct more accurate psychological interventions during the pandemic.

4.3. Implication, future direction, and limitation

Our findings provided brightening sparkling on targeting OCS affected by HA during the COVID-19 epidemic via providing adaptive emotion regulating strategies and assessing the level of personality traits. A previous study has shown that improving the ability to emotionally regulate can enhance the effectiveness of psychological treatment towards OCS (Yap et al., 2018). For instance, they would recognize and accept negative feelings facilitated to lessen his/her sense of out-of-control (Fergus & Bardeen, 2014).

CBT has been considered to be an effective intervention for the general public during the pandemic (Wang et al., 2020; Yin et al., 2020) and can adjust individuals' maladaptive ways to regulate emotions, and coach individuals to improve their OCS caused by HA. Previous evidence has shown that, through an abbreviated version of a CBT-based emotional therapy method (Berking, 2017), the response ability of OC patients would be enhanced (Berking et al., 2008). Therefore, the "Nonacceptance", "Non-clarity" and "Non-awareness" have be improved significantly. Moreover, the ability to accept and endure negative emotions was revealed to be the strongest predictor of treatment effects (Berking et al., 2008).

Several limitations should be noted in the present study. First, the four used variables may have different influence among the confirmed patients, suspected patients, medical staff and the general public; however, most of the recruited participants was the general public, lacking the comparison with clinical samples. Second, as the cross-sectional design, the results can not verify the causal relationship among variables. Finally, in addition to DER, other factors directly influencing the relation between HA and OCS are also worthy of attention in future research.

CRediT authorship contribution statement

In this manuscript, Hong, D. conducted the data analyses, wrote and revised the manuscript. Zhu, Y. designed the research, and participated in collecting data. Yu, M. designed the research, participated in collecting data and critically reviewed and revised the manuscript. The corresponding author (Dr. Meng Yu) is responsible for ensuring that the descriptions are accurate and agreed by all authors.

Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.paid.2021.111254.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders*. American Psychiatric Association. (Fifth Edition).

Bardeen, J. R., & Fergus, T. A. (2014). An examination of the incremental contribution of emotion regulation difficulties to health anxiety beyond specific emotion regulation strategies. *Journal of Anxiety Disorders, 28*(4), 394–401. https://doi.org/10.1016/j.janxdis.2014.03.002.

Bardeen, J. R., Stevens, E. N., Murdock, K. W., & Lovejoy, M. C. (2013). A preliminary investigation of sex differences in associations between emotion regulation difficulties and higher-order cognitive abilities. *Personality and Individual Differences, 55*(1), 70–75. https://doi.org/10.1016/j.paid.2013.02.003.

Berking, M. (2017). *Training emotionaler kompetenzen*. Springer-Verlag.

Berking, M., Wupperman, P., Reichardt, A., Pejic, T., Dippel, A., & Znoj, H. (2008). Emotion-regulation skills as a treatment target in psychotherapy. *Behavior Research and Therapy, 46*(11), 1230–1237. https://doi.org/10.1016/j.brat.2008.08.005.

Calkins, A. W., Berman, N. C., & Wilhelm, S. (2013). Recent advances in research on cognition and emotion in OCD: A review. *Current Psychiatry Reports, 15*(5), 357. https://doi.org/10.1007/s11920-013-0357-4.

Chen, N., Zhou, M., Dong, X., Qu, J., Gong, F., Han, Y., … Yu, T. (2020). Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: A descriptive study. *The Lancet, 395*(10223), 507–513. https://doi.org/10.1016/S0140-6736(20)30211-7.

China National Health Commission. (2020). Guiding Principles for Emergency Psychological Crisis Intervention in the Novel Coronavirus PneumoniaGuiding principles for emergency psychological crisis intervention in the novel coronavirus pneumonia. *Chinese National Health Commission for Disease Control and Prevention* (Accessed 27 January 2020).

de la Cruz, L. F., Landau, D., Iervolino, A. C., Santo, S., Pertusa, A., Singh, S., & Mataix-Cols, D. (2013). Experiential avoidance and emotion regulation difficulties in hoarding disorder. *Journal of Anxiety Disorders, 27*(2), 204–209. https://doi.org/10.1016/j.janxdis.2013.01.004.

Dearing, E., & Hamilton, L. C. (2006). Contemporary advances and classic advice for analyzing mediating and moderating variables. In *Monographs of the society for research in child development*. https://doi.org/10.1111/j.1540-5834.2006.00406.x.

Erceg-Hurn, D. M., & Mirosevich, V. M. (2008). Modern robust statistical methods: An easy way to maximize the accuracy and power of your research. *American Psychologist, 63*(7), 591. https://doi.org/10.1037/0003-066X.63.7.591.

Fergus, T. A., & Bardeen, J. R. (2014). Emotion regulation and obsessive–compulsive symptoms: A further examination of associations. *Journal of Obsessive-Compulsive and Related Disorders, 3*(3), 243–248. https://doi.org/10.1016/j.jocrd.2014.06.001.

Foa, E. B., Kozak, M. J., Salkovskis, P. M., Coles, M. E., & Amir, N. (1998). The validation of a new obsessive–compulsive disorder scale: The Obsessive–Compulsive Inventory. *Psychological Assessment, 10*(3), 206. https://doi.org/10.1037/1040-3590.10.3.206.

Görgen, S. M., Hiller, W., & Witthöft, M. (2014). Health anxiety, cognitive coping, and emotion regulation: A latent variable approach. *International Journal of Behavioral Medicine, 21*(2), 364–374. https://doi.org/10.1007/s12529-013-9297-y.

Gratz, K. L., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the difficulties in emotion regulation scale. *Journal of Psychopathology and Behavioral Assessment, 26*(1). https://doi.org/10.1023/B:JOBA.0000007455.08539.94.

Gratz,, K. L., & Roemer, L. (2008). The relationship between emotion dysregulation and deliberate self-harm among female undergraduate students at an urban commuter university. *Cognitive Behaviour Therapy, 37*(1), 14–25. https://doi.org/10.1080/16506070701819519524.

Harkness, A. R., Reynolds, S. M., & Lilienfeld, S. O. (2014). A review of systems for psychology and psychiatry: Adaptive systems, personality psychopathology five (PSY–5), and the DSM–5. *Journal of Personality Assessment, 96*(2), 121–139. https://doi.org/10.1080/00223891.2013.823438.

Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford publications.

Hoyle, R. H. (2012). *Handbook of structural equation modeling*. Guilford press.

Krueger, R. F., Derringer, J., Markon, K. E., Watson, D., & Skodol, A. E. (2012). Initial construction of a maladaptive personality trait model and inventory for DSM-5. *Psychological Medicine, 42*(9), 1879. https://doi.org/10.1017/S0033291711002674.

Li, J., Han, Z. R., Gao, M. M., Sun, X., & Ahemaitijiang, N. (2018). Psychometric properties of the Chinese version of the Difficulties in Emotion Regulation Scale (DERS): Factor structure, reliability, and validity. *Psychological Assessment, 30*(5), e1–e9. https://doi.org/10.1037/pas0000582.

Moulding, R., & Kyrios, M. (2006). Anxiety disorders and control related beliefs: The exemplar of obsessive–compulsive disorder (OCD). *Clinical Psychology Review, 26*(5), 573–583. https://doi.org/10.1016/j.cpr.2006.01.009.

National Health Commission of the People's Republic of China. (2020). The latest situation of the pneumonia epidemic caused by the new coronavirus as of 24:00 on January 31. http://www.nhc.gov.cn/xcs/yqtb/202002/84faf71e096446fdb1ae44939ba5c528.shtml (Date accessed: February 1, 2020).

Pollock, N. C., McCabe, G. A., Southard, A. C., & Zeigler-Hill, V. (2016). Pathological personality traits and emotion regulation difficulties. *Personality and Individual Differences, 95*, 168–177. https://doi.org/10.1016/j.paid.2016.02.049.

Putnam, K. M., & Silk, K. R. (2005). Emotion dysregulation and the development of borderline personality disorder. *Development and Psychopathology, 17*(4), 899–925. https://doi.org/10.1017/S0954579405050431.

Salkovskis, P. M., Rimes, K. A., & Warwick, H. M. C. (2002). The Health Anxiety Inventory: Development and validation of scales for the measurement of health anxiety and hypochondriasis. *Psychological medicine, 32*(5), 843 (10.1017/S0033291702005822).

Salkovskis, P. M., & Warwick, H. M. (1986). Morbid preoccupations, health anxiety and reassurance: A cognitive-behavioural approach to hypochondriasis. *Behaviour Research and Therapy, 24*(5), 597–602. https://doi.org/10.1016/0005-7967(86)90041-0.

Sunderland, M., Newby, J. M., & Andrews, G. (2013). Health anxiety in Australia: Prevalence, comorbidity, disability and service use. *The British Journal of Psychiatry, 202*(1), 56–61. https://doi.org/10.1192/bjp.bp.111.103960.

Tang, S. Q., Wang, J. P., Tang, T., & Zhao, L. N. (2011). Reliability and validity of obsessive-compulsive inventory-revised in Chinese College Students. *Chinese Journal of Clinical Psychology, 19*(5), 619–621. https://doi.org/10.16128/j.cnki.1005-3611.2011.05.038.

Taylor, S., & Asmundson, G. J. (2004). *Treating health anxiety: A cognitive-behavioral approach*. Guilford Press.

Wang, C. Y., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., & Ho, R. C. (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *International Journal of Environmental Research and Public Health, 17*(5), 1729. https://doi.org/10.3390/ijerph17051729.

World Health Organization. (2020). Coronavirus disease 2019 (COVID-19): Situation report, 82. Retrieved from https://apps.who.int/iris/bitstream/handle/10665/331780/nCoVsitrep11Apr2020-eng.pdf.

Yap, K., Mogan, C., Moriarty, A., Dowling, N., Blair-West, S., Gelgec, C., & Moulding, R. (2018). Emotion regulation difficulties in obsessive-compulsive disorder. *Journal of Clinical Psychology, 74*(4), 695–709. https://doi.org/10.1002/jclp.22553.

Yin, W. Z., Yu, M., Li, L. B., Huang, H., & Wang, J. P. (2020). Research on psychological mechanism and intervention strategies for health anxiety during the COVID-19 pandemics: A view based on cognitive behavior theory. *Sichuan Mental Health, 33* (03), 193–196. https://doi.org/10.11886/scjsws20200427002.

Zhang, W., Wang, M., Yu, M., & Wang, J. (2021). The hierarchical structure and predictive validity of the personality inventory for dsm-5 in Chinese nonclinical adolescents. *Assessment.*. https://doi.org/10.1177/10731911211022835.

Zhang, Y. Q., Liu, R., Li, G., Mao, S., & Yuan, Y. (2015). The reliability and validity of a Chinese-version Short Health Anxiety Inventory: An investigation of university students. *Neuropsychiatric Disease and Treatment, 11,1739*. https://doi.org/10.2147/NDT.S83501.