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Subtypes of social withdrawal and mental health trajectories during COVID-19 pandemic

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ABSTRACT

The outbreak of Coronavirus Disease 2019 (COVID-19) has pervasive implications for the well-being of people, especially for the social withdrawn individuals. The present study examined changes of well-being among people in distinct subgroups of social withdrawal – shyness, unsociability, and social avoidance – in different phases of the COVID-19 pandemic using six-wave longitudinal data in China ($N = 222$; 54.50% female). Results showed that, in general, well-being sharply decreased from the initial phase to the peak phase of the pandemic, but steadily recovered after the peak phase. People in different withdrawal groups displayed different levels and trajectories of well-being during a period of six months. The current study has implications for developing targeted interventions for vulnerable people in public health crisis.

1. Introduction

Ever since the first cluster of pneumonia cases infected by a novel coronavirus (COVID-19) was reported in Wuhan, China, the virus has spread worldwide at an alarming rate. On March 11th, 2020, COVID-19 was officially declared to be a pandemic by the World Health Organization. More than 271 million global cases and more than 5 million global deaths have been reported by December 17th, 2021 (WHO, 2021). Exposure to extensive media coverage of the pandemic, deprivation of social interaction, and disruptions to daily routines are likely to create a global atmosphere of anxiety and depression, which severely threatened the public's well-being (Esterwood & Saeed, 2020; Xu et al., 2020).

1.1. Confinement measures, social isolation, and well-being risks

As an effort to control the spread of the virus, countries around the world have implemented different public health measures, including city-wide lockdowns, quarantine, social distancing, and travel

restrictions (Banerjee & Rai, 2020; Greenstone & Nigam, 2020). Although effective in controlling infection rate, quarantine shows side effects on people's well-being due to lower levels of inter-personal social interactions, separation from loved ones and support systems, and the loss of freedom (Brooks et al., 2020; Xu et al., 2020).

According to the transactional stress model (e.g., Lazarus, 1999; Sameroff, 2009), when individuals experience stress in an adverse setting, they may interpret and respond to the situation differently. Therefore, people who are more susceptible to the pandemic and its related social isolation may be more at risk than others in psychological maladjustment. In this study, we were interested in how social withdrawal was related to well-being in different phases of the COVID-19 pandemic. Another important aim of the present study was to examine whether different subtypes of social withdrawal could be identified in Chinese adults in the context of the pandemic.

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1.2. Differential responses of social withdrawal subgroups to the COVID-19 pandemic

Social withdrawal is a behavioral tendency to engage in solitary behavior and to remove from opportunities for social interaction (Rubin et al., 2009). It is a multidimensional construct that reflects a diverse range of underlying emotional and motivational substrates, including shyness, unsociability, and social avoidance (Coplan et al., 2016; Nelson, 2013).

Shy people have the motivation to interact with others, but they fear to do so (Rubin et al., 2009). In the face of the pandemic, it is conceivable that shy people's well-being may be severely impacted by the sudden outbreak of the pandemic and may not recover even after the confinement measures are lifted due to their inability to actively seek social support. From a different perspective, it is also possible that the deprivation of face-to-face communication due to the confinement policies is a relief for shy people, who may take this opportunity to engage in online social interaction without feeling fearful as they normally would when they engage in in-person social situations (Appel & Gnambs, 2019; Chak & Leung, 2004). If this was the case, the pandemic might not have evident negative effects on shy people's well-being.

Unsociable individuals tend to show a lack of desire to interact with others (Rubin et al., 2009). Research findings show that unsociability is relatively benign - unsociable people tend to have relatively robust social functioning because they actually meet their requirement of "just enough" levels of social interaction, which protects them from psychological maladjustments (Coplan et al., 2013; Nelson, 2013). Therefore, we hypothesized that unsociable people might show a similar pattern of well-being trajectory as their non-withdrawal peers during the pandemic.

The socially avoidant (also called shy-unsociable) individuals had the characteristics of both shyness and unsociability, showing mixed tendencies of a lack of interest in interacting with others, internal anxiety in challenging situations, and social avoidance (Coplan et al., 2015). Compared with individuals of other social withdrawal subtypes, socially avoidant individuals reported the highest levels of depressive and anxious symptoms and the lowest levels of well-being in both Western (Coplan et al., 2006, 2013) and Chinese samples (Coplan et al., 2016). Therefore, we hypothesized that socially avoidant people might show a consistent lowest level of well-being from the initial phase to the mitigation phase of the pandemic.

1.3. Overview of the current study

The aim of the current study was to examine whether and how individuals of different social withdrawal subtypes respond to the COVID-19 pandemic using a six-wave longitudinal data in China. The first assessment of the present study was completed at the initial phase of the pandemic (early January 2020; Time 1) when the first COVID-19 cases had already been reported but did not raise public concern. The original sample was reassessed monthly from mid-February (Time 2; the peak phase of the pandemic in China) to mid-June 2020 (Time 6; the mitigation phase of the pandemic in China). Therefore, the duration of this study covered different phases of the pandemic, during which the infected cases in China surged and then steadily declined.

Based on existing theories and empirical studies of social withdrawal (Coplan et al., 2013, 2016), we expected that four subgroups (i.e., non-withdrawal, shyness, unsociability, and social avoidance) might be identified based on their social withdrawal features using cluster analysis. We then examined whether individuals in the four subgroups would have different responses to the pandemic as indicated by their well-being levels.

2. Method

2.1. Participants and procedures

From January 3rd to 5th, 2020, 266 Chinese adults participated in the initial study, with 222 (83.46%) valid cases who had filled all the questionnaires. The final sample included 222 adults (121 females, 54.50%) from 58 cities in 26 provinces in China. We tracked the participants monthly from February to June 2020 (see Fig. 1). Consent was obtained from all the participants. For each assessment, participants filled out the questionnaires voluntarily through a survey website (www.wjx.cn). The participants were compensated with 12 yuan (approximately \$ 2) each time upon completing the survey. The data for the current study were drawn from a larger longitudinal project on individuals' personality traits and mental health. All the procedures were approved by the institutional review board of the author's host university.

At Time 1, the participants' ages ranged from 19 to 64 years old ($M = 31.68$, $SD = 7.90$). Their monthly income ranged from "lower than 5,000 yuan (about 769 USD)" (49 cases, 22.07%) to "higher than 35,000 yuan (about 5,385 USD)" (5 cases, 2.25%), with a median of "between 5,000 and 10,000 (about 1,538 USD)" yuan.

Of the original participants, 164 (73.87%; Time 2), 123 (54.41%; Time 3), 161 (72.52%; Time 4), 157 (70.72%; Time 5), and 157 (70.72%; Time 6) participated in the follow-up surveys. Little's (1988) missing completely at random (MCAR) test was not significant, $\chi^2(205) = 228.95$, $p = .121$, suggesting that the missing pattern conformed to MCAR.

2.2. Measures

2.2.1. Social withdrawal prior to the outbreak of COVID-19 pandemic (Time 1)

Social withdrawal, including shyness and unsociability, was assessed using the Solitude Behavioral Scale (Chen et al., 2012). Participants rated their levels of shyness (7 items, e.g., "I feel uncomfortable when I'm with people I don't know") and unsociability (9 items, e.g., "I like to be alone, and I have no interest in other people") on 5-point scales ranging from 1 = *strongly disagree* to 5 = *strongly agree*. Results from factor analyses indicated that the items loaded on the corresponding factors, with all factor loadings above 0.46, and all cross-loadings below 0.19 (see Table S1 for detail). Composite scores were created by adding item scores in each subscale, with higher scores indicating higher levels of shyness or unsociability. The Cronbach's alphas of the measurements in the present study are listed in Table 1.

2.2.2. Well-being from time 1 to time 6

Well-being was assessed using the 18-item Chinese version of the General Well-Being Schedule (GWB; Duan, 1996; Fazio, 1977), which contains six dimensions: anxiety, depression, general health, positive well-being, self-control, and vitality (Brook et al., 1979). This revised scale has shown good reliability and validity in Chinese samples (Fang et al., 2018; Li et al., 2015). Participants rated their well-being in the past month (e.g., "How happy, satisfied, or pleased have you been with your personal life?"). The intercorrelations among all 18 items showed that item 15 ("How concerned or worried about your health have you been?") generally did not correlate with other items. Further examination illustrated that the translation of this item was not accurate, such that "concern" has been translated into "guanxin (care for)" in Chinese. Therefore, we removed item 15 and added the scores of the other 17 items, with higher scores representing better well-being.

2.3. Statistical analysis

To identify the best-fitting trajectory of well-being for the overall sample, unconditional latent growth curve modeling was conducted

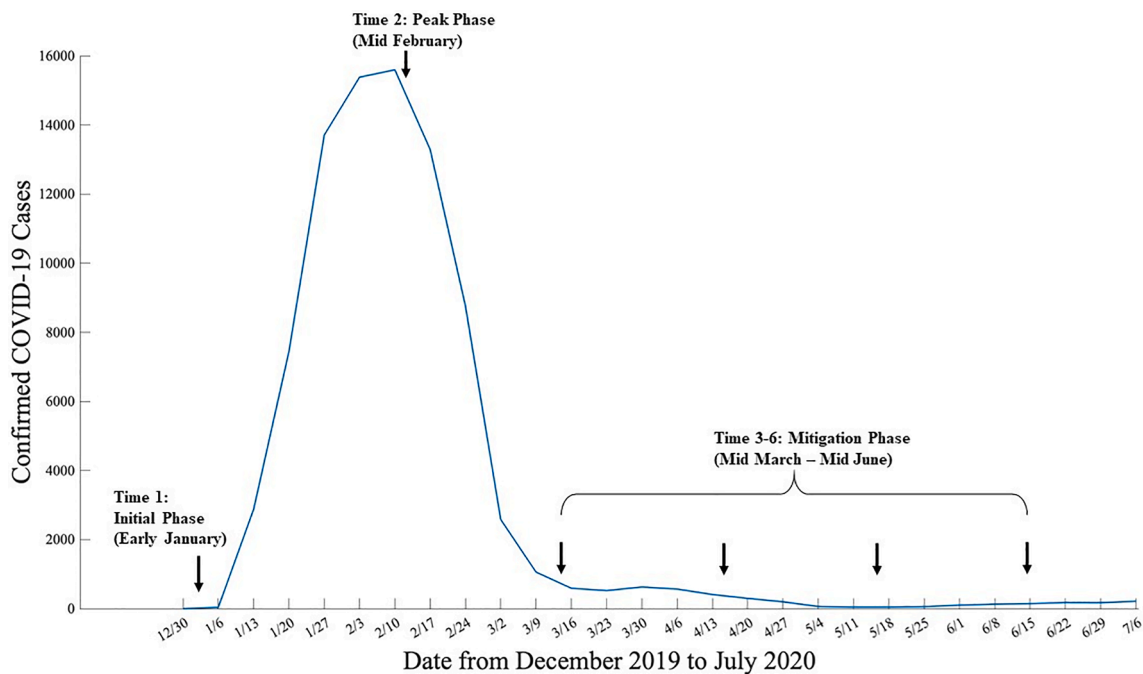


Fig. 1. The Trajectory of Current Confirmed Cases of COVID-19 in China and Survey Timeline.

Table 1
Descriptive Statistics, Zero-Order Correlations, and Cronbach Alphas.

Variables	1	2	3	4	5	6	7	8
1. T1 Shyness	–							
2. T1 Unsociability	0.49	–						
3. T1 Well-Being	–0.55	–0.47	–					
4. T2 Well-Being	–0.15	–0.26	0.56	–				
5. T3 Well-Being	–0.30	–0.37	0.63	0.72	–			
6. T4 Well-Being	–0.31	–0.37	0.66	0.70	0.78	–		
7. T5 Well-Being	–0.29	–0.34	0.61	0.65	0.74	0.79	–	
8. T6 Well-Being	–0.40	–0.30	0.67	0.59	0.71	0.75	0.77	–
M	19.91	22.54	63.00	61.99	65.33	64.96	66.80	66.69
SD	6.62	7.62	13.00	12.92	14.17	14.05	13.76	13.67
α	0.89	0.90	0.86	0.88	0.91	0.91	0.90	0.88

Note. T1-T6 = Time points of assessment.
Bold coefficients indicate significance at $p < .05$ (two-tailed).

using Mplus 7.4 (Muthen & Muthen, 1998-2012) with full information maximum likelihood estimation (FIML; Enders & Bandalos, 2001). Separate models of linear change, quadratic change, two-stage linear change, and two-stage quadratic change were compared with each other based on the Bayesian information criterion (BIC), a preferred criterion to compare non-nested models ($\Delta BIC = 2$ is the threshold of the significant distinction between two models; Raftery, 1995). Given that the stage 1 only has two-time points, the variance of the latent slope of stage 1 was fixed to zero to help identify the growth model (Muthen, 2007).

By setting the paths from Time 1 observed well-being to the latent linear and quadratic slopes at zero, the latent intercept could be interpreted as the level of well-being at the first time point (i.e., Time 1; Duncan et al., 1999). To describe the well-being at Time 6, we re-centered the latent linear and quadratic slopes, so that the latent intercept could be interpreted as the level of mental health at Time 6 (Little et al., 2006). For parsimony, the latent quadratic term would be retained only if its mean was significantly different from zero.

Then, to identify subtypes of social withdrawal, we conducted a two-step cluster analysis using the procedure suggested by other researchers (Gore, 2000; Teppers et al., 2014). First, Ward’s method was used to perform a hierarchical cluster analysis based on squared Euclidian distances. The optimal number of clusters was decided by several criteria

including the scree plot of the coefficients of the agglomeration schedule, theoretical meaningfulness of each cluster, and parsimony (Teppers et al., 2014; Yim & Ramdeen, 2015). Second, k -means cluster analysis with the optimal group number was conducted to further classify the cases. The final groups of subtypes were based on the results of k -means cluster analysis.

To further compare the latent intercepts and slopes between each pair of the social withdrawal clusters, we plotted the mean well-being levels of each subgroup across the six time points. Then, we dummy coded the subgroups and added the dummy variables to a series of conditional latent growth curve models, examining whether well-being trajectories varied as a function of different groups of social withdrawal subtypes.

3. Results

3.1. Descriptive statistics and preliminary correlations

Table 1 shows the means, standard deviations, internal reliabilities, and intercorrelations for all study variables. Shyness and unsociability correlated moderately ($r = 0.49$). In general, both shyness ($r_s = -0.27$ to -0.53 , $ps < 0.001$) and unsociability ($r_s = -0.23$ to -0.44 , $ps < 0.005$)

were negatively associated with well-being across different phases of the pandemic.

3.2. Well-being trajectory of the whole sample

To identify the optimal well-being trajectory in the current sample, we fitted a series of unconditional growth models. The best-fit model suggested by Bayesian information criterion (BIC) was a two-stage linear change pattern model (BIC = 7332.85), as compared with other competitive models (BIC for linear change = 7337.59, BIC for quadratic change = 7335.89, BIC for two-stage quadratic change = 7336.32; Δ BICs > 3.04). As shown in Fig. 2, the level of mental health sharply decreased at the breakout of the pandemic ($B_{slope1} = -1.78, SE = 0.77, p = .021$), but steadily recovered after the peak COVID-19 phase ($B_{slope2} = 1.20, SE = 0.22, p < .001$).

3.3. Identifying social withdrawal subtypes using cluster analysis

In hierarchical cluster analysis, the scree plot elbow of the agglomeration schedule suggested an optimal solution of a 4-class membership ($n_{membership} = N - n_{stage}$; see Fig. S1), which was consistent with theories and previous studies about social withdrawal subtypes (Coplan et al., 2013, 2016; Nelson, 2013). Then, a 4-class *k*-means cluster analysis was performed to further classify all the cases into four subgroups. Specifically, as shown in Fig. 3, there were 43 cases (19.4%) in the social avoidance group (high levels of both shyness and unsociability), 57 cases (25.7%) in the shyness group (high levels of shyness and low levels of unsociability), 45 cases (20.3%) in the unsociability group (high levels of unsociability but low levels of shyness), and 77 cases (34.7%) in the non-withdrawal group (low levels of both shyness and unsociability). A follow-up multivariate analysis of variance suggested significant differences in the levels of shyness ($F(3, 218) = 268.15, p < .001$) and unsociability ($F(3, 218) = 251.04, p < .001$) across four subgroups.

3.4. Levels and trajectories of well-being in social withdrawal subtypes

Multi-group unconditional growth models were conducted to examine the trajectories of well-being across each social withdrawal subtype. As presented in Fig. 4, the non-withdrawal and unsociability subgroups have decreased levels of well-being from the initiation to the peak phase of the pandemic in China, followed by a steady increase after the peak COVID-19 phase. However, the levels of well-being for individuals in the shyness and social avoidance groups do not fluctuate across different phases of the pandemic.

In order to further compare the latent intercepts and slopes between

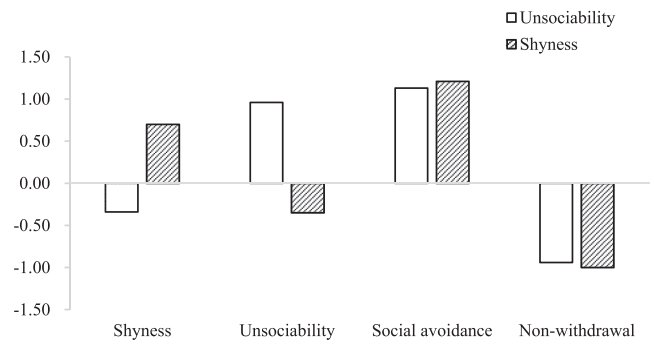


Fig. 3. Final Four-Cluster Solution for Social Withdrawal Subtypes.

each pair of the four clusters, we dummy coded the cluster membership variable, using the non-withdrawal, unsociability, and shyness groups as the reference group respectively. Based on previous studies (Cao et al., 2020; Gerhold, 2020; Qiu et al., 2020; Yao et al., 2020), we controlled for participants' gender, age, and monthly income as confounding variables. In addition, given that the participants came from 26 provinces, which have different distances to Wuhan, we calculated the correlation between distance from the capital of the province to Wuhan and well-being. Analyses showed that the distance from Wuhan was not significantly correlated with well-being across six waves ($r_s = -0.12$ to $0.03, p_s > 0.14$). Therefore, in our sample, the distance to Wuhan did not influence the assessments of well-being and was not considered as a control variable in formal analyses.

The results of the comparisons of trajectory parameters among clusters are presented in Table 2 (for 95% CI of the estimated coefficients of each comparison, see Table S2). Specifically, the social avoidance group reported the lowest levels of well-being at both the initial and the mitigation phases (i.e., intercepts at Time 1 and Time 6). Though higher than the social avoidance group, levels of well-being reported by individuals in the shyness and unsociability groups were lower than that reported by the non-withdrawal group at the initial phase (i.e., intercept at Time 1) and the mitigation phase (i.e., intercept at Time 6). In addition, the decrease (i.e., slope) in well-being from the initial phase (Time 1) to the peak phase (Time 2) in both the non-withdrawal and the unsociability group were larger than that in the social avoidance group. The decrease was also more salient in the unsociability group than the shyness group. Furthermore, the recovery (i.e., slope) in well-being after the peak COVID-19 phase was faster in the non-withdrawal and unsociability groups than that in the shyness group.

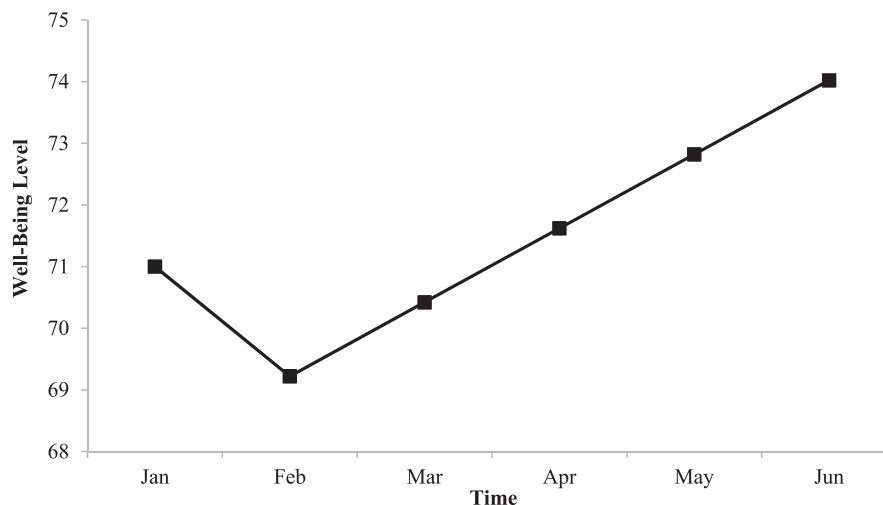


Fig. 2. Well-Being Trajectory for the Overall Sample in Different Phases of the COVID-19 Pandemic (N = 222).

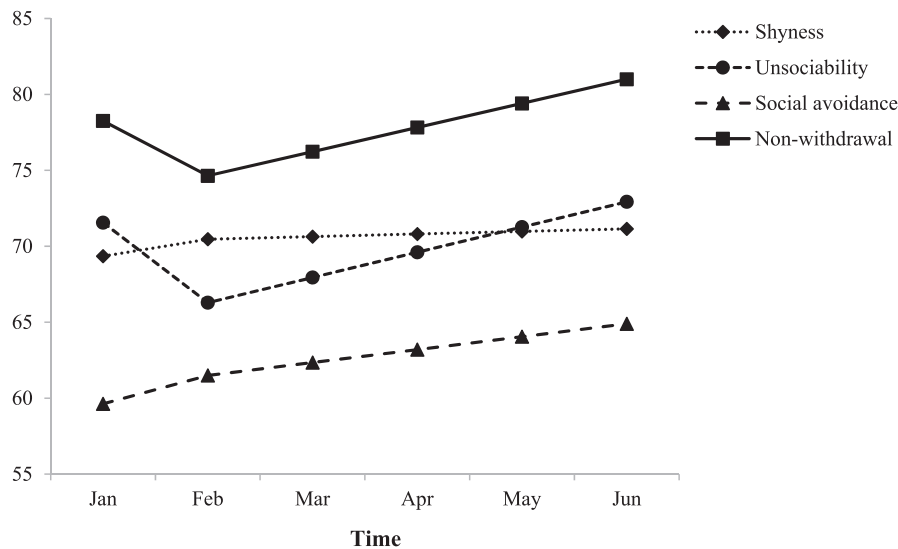


Fig. 4. Well-Being Trajectories for Individuals of Four Social Withdrawal Subtypes in Different Phases of the COVID-19 Pandemic.

Table 2

Comparisons of Social Withdrawal Subgroups on Levels and Slopes of Well-Being during Different Phases of the COVID-19 Pandemic: Means (Standard Errors).

Index of well-being	Groups				
	Total	Shyness	Unsociability	Social avoidance	Non-withdrawal
<i>n</i>	222	57	45	43	77
Intercept (January)	71.00(0.92)	69.35 _b (1.40)	71.56 _b (1.97)	59.63 _c (2.24)	78.25 _a (1.23)
Intercept (June)	74.02(1.03)	71.14 _b (1.71)	72.94 _b (2.17)	-64.88 _c (2.73)	81.02 _a (1.47)
Slope1	-1.78(0.77)	1.12 _{a,b} (1.30)	-5.27 _c (1.70)	1.87 _a (2.38)	-3.61 _{b,c} (1.05)
Slope2	1.20(0.22)	0.17 _a (0.48)	01.66 _b (0.44)	0.85 _{a,b} (0.66)	1.59 _b (0.32)

Note. Means in the same row with different subscripts differ significantly at the 0.05 level. Intercept (January) = Well-being in January (Time 1; the initial phase), 2020. Intercept (June) = Well-being in June (Time 6; the mitigation phase), 2020. Slope 1 = the slope of the well-being trajectory from the initial phase (Time 1) to the peak phase (Time 2). Slope 2 = the slope of the well-being trajectory from the peak phase (Time 2) to the mitigation phase (Time 6). Bolded coefficients were significant at $p < .05$.

4. Discussion

The results from the present study showed that, in general, the participants' well-being levels fluctuated during different phases of the COVID-19 pandemic. In addition, consistent with previous studies, we identified three maladaptive social withdrawal subtypes (i.e., shyness, unsociability, and social avoidance) and a non-withdrawal subgroup in the current sample. Individuals of different social withdrawal subtypes displayed differential well-being trajectories in response to the COVID-19 pandemic.

4.1. Overall well-being trajectory during the COVID-19 pandemic

The well-being trajectory of all participants showed a significant decrease from the initial phase to the peak phase of the COVID-19 pandemic, which is consistent with existing evidence about the detrimental influence of the pandemic on the public's well-being (Rajkumar, 2020). After the peak phase of the pandemic in mid-February, the well-being of the overall sample steadily recovered. These results echoed some previous studies finding decreased levels of psychological distress and increased levels of well-being in the general population at follow-up assessments several weeks later, as compared with the point of outbreak (Fried et al., 2020; Stieger et al., 2020). However, several studies did not find significant changes in well-being or maladaptive responses (Planchuelo-Gómez et al., 2020; Wang et al., 2020), perhaps because these studies included only two, or, at most, three-time points, lasting for about one or two months in total, which might be insufficient for detecting the general trend of well-being across various phases of the

pandemic. Based on six time points of assessments over a relatively long period, our study suggested that whereas individuals reported dramatically increased problems at the initial outbreak of the pandemic, their well-being recovered as the spread of the virus being controlled.

4.2. Differential responses of individuals of social withdrawal subtypes to the COVID-19 pandemic

The present study is the first to find three maladaptive social withdrawal subtypes (i.e., shyness, unsociability, social avoidance) along with a non-withdrawal subgroup in Chinese adults, which meshes well with Asendorpf's (1990) model and previous studies with younger age groups (Coplan et al., 2013, 2016; Nelson, 2013).

Our results indicated that compared with the non-withdrawal group, all three social withdrawal groups had poorer well-being across all phases of the pandemic, suggesting that social withdrawal among Chinese adults might be a risk factor for reduced well-being. However, our results showed that individuals of different social withdrawal subtypes had different well-being trajectories in response to the pandemic.

The well-being of the shyness group did not change with the development of the COVID-19 pandemic, indicated by a stable trajectory of well-being levels from Time 1 (January 2020) to Time 6 (June 2020). Shy people typically have the desire to interact with others, but they are fearful about social novelty (Rubin et al., 2009). In the context of the pandemic, the compulsory quarantine and social distance policies did not drastically change the level of shy people's social engagement, which had already been low. Even at the later phases of the pandemic, shy people were still unable to seek social support and initiate in-person

social interaction because of their fearfulness, which led to a lack of improvement in well-being after the peak phase of the pandemic.

Different from the shy group, the well-being of the unsociability group significantly decreased as the pandemic reached the peak phase and steadily recovered as the pandemic was controlled. It is suggested that the social interaction capability of unsociable people is as good as that of their non-withdrawn peers (Nelson, 2013). Therefore, it may be understandable that although unsociable individuals were negatively influenced by the pandemic at the peak phase, they were able to use their social skills to engage in social interactions again, which may bring their well-being level back to normal when the social-distancing policy was lifted.

It should be noted that while unsociable people seemed to respond similarly to the pandemic as non-withdrawn people, the former consistently had lower levels of well-being than the latter across all phases of the pandemic. Although considered as relatively benign in Western cultures (Coplan & Armer, 2007), unsociability is viewed as deviant and selfish in China (Chen & French, 2008) and is associated with social and psychological difficulties in children and adolescents (Ding et al., 2020; Liu et al., 2017). According to the developmental timing effects for unsociability (Coplan et al., 2019), unsociability may become increasingly adaptive from late adolescence to adulthood due to the growing need for constructive solitude. However, the current study indicated that unsociability is still harmful to the well-being of Chinese adults.

4.3. Implications, limitations, and future directions

Previous studies suggest that it is important to pay attention to individuals with dispositional risky diathesis (Rajkumar, 2020). Our results suggested that the subtypes of social withdrawal had distinct implications for individuals' well-being during the COVID-19 pandemic.

From the practical perspective, the present study has important implications. First, targeted intervention for people with different social withdrawal subtypes during the pandemic is needed. For example, it is important to help shy people develop social skills to handle challenges in social interactions, which can help them overcome worries and fear in difficult situations. For unsociable people, motivating them to engage in social interactions may be useful. Intervention for socially avoidant individuals may be the most challenging given their characteristics of both shyness and unsociability. It may be necessary to use multiple strategies including social skill training, encouragement for social interactions, and other efforts.

In addition, because socially withdrawn individuals have few interactions with others, positive family relationships may be particularly important and can serve as a resource for them to mitigate psychological distress. Researchers and professionals may incorporate family-based intervention programs in helping withdrawn people in adverse circumstances. It has been found that the characteristics of social withdrawal subtypes among Chinese people today are similar to those in North America and other countries (e.g., Bowker & Raja, 2011; Coplan et al., 2006, 2013). Therefore, the results of the present study may provide valuable information for improving the well-being of social withdrawn individuals in countries that are still in the process of combating the pandemic.

There are several limitations in the present study. First, the severity of the pandemic and the enforcement of the confinement measures paralleled each other, making it difficult to differentiate the impact of the pandemic itself from the socially isolating nature of the quarantine on the public's well-being. It is necessary for future studies to collect information about the perceived severity of the pandemic and the quantity and quality of social interaction during the pandemic. Second, the current study concentrated on the levels and trajectories of well-being among different social withdrawal subtypes. We did not examine the processes involved in the associations between withdrawal and well-being. It is important for future studies to explore social and

cognitive factors that contribute to the links between social withdrawal and well-being. Third, self-reported measures were used in the present study. Future studies will benefit from using multi-method and multi-informant designs to examine the links between social withdrawal and well-being. Despite the limitations, the current study made a significant contribution to our understanding of different social withdrawal subtypes in Chinese adults and their well-being in response to the COVID-19 pandemic.

Author note

The first author designed the study. The first to the seventh authors contributed to data interpretation and writing up the manuscript. The third to the sixth authors assisted with data acquisition and critical revisions of the manuscript. The eighth to the tenth authors assisted with study design.

Declaration of Competing Interest

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.

Data availability

Data will be made available on request.

Acknowledgements

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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