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Relationship between mindfulness and hoarding among Chinese college students: a terror management theory perspective

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Although mindfulness has been shown to bring many benefits, no research to date has examined whether it is associated with reduced hoarding behavior during health disasters. This study employed terror management theory to explore “how” and “why” mindfulness correlates with hoarding behavior. A two-wave survey was conducted among 310 Chinese university students with a one-week interval during the COVID-19 outbreak. Structural Equation Modeling analysis indicated that mindfulness was negatively correlated with hoarding behavior through three distinct pathways: a simple mediation through decreased death anxiety, a sequential mediation through increased self-esteem and decreased death anxiety, and another sequential mediation through increased perceived social support and decreased death anxiety. These pathways elucidate a novel understanding of how mindfulness contributes to less hoarding behavior, while extending the applications of terror management theory to crisis-related consumption. The results underscore mindfulness as a key factor in curbing hoarding behavior during COVID-19 pandemic, with implications for practical interventions and future research on behavioral responses to health-related crises.

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Introduction

The COVID-19 pandemic has precipitated significant changes to people's lives and work (e.g., Ma et al. 2024; Tei and Fujino 2022; Zhan et al. 2024), causing many to think deeply about mortality. This mortality salience often leads to death anxiety, which may drive people toward materialistic consumerism as they seek security (Gobrecht and Marchand 2023). In this context, acquiring and stockpiling essential goods can create an illusion of personal control amid uncertainty (Kirk and Rifkin 2020). The pandemic led many consumers to transition from routine stockpiling to extreme purchasing, such as hoarding excessive household supplies (e.g., Islam et al. 2021; Rune and Keech 2023; Tse et al. 2022). Heightened risk perception has been found to psychologically push people toward stockpiling protective items, including sanitizers and medical masks (Van Bavel et al. 2020). Similarly, public fears about shortages during lockdowns can drive the excessive accumulation of daily necessities, particularly non-perishable food and medications (Dubey et al. 2020).

Hoarding behavior is characterized by the excessive acquisition and stockpiling of essential goods beyond immediate needs (Chu 2018; Kirk and Rifkin 2020). While sharing phenomenological overlap with hoarding disorder (HD), HD demonstrates a pathognomonic clinging to possessions without regard to utility or value, culminating in clinically significant impairment (Frost et al. 2012). However, these conditions differ in their duration, underlying motivation, and functional impact (Frost et al. 2012; Kirk and Rifkin 2020; Timpano et al. 2015). Hoarding behavior is phylogenetically conserved, representing a hardwired survival response to environmental uncertainty (Frost and Gross 1993). It primarily manifests through consumption behaviors and typically subsides when external threats diminish (Kirk and Rifkin 2020; Tse et al. 2022), whereas HD involves chronic dysfunction, emotional attachment to possessions, and pathological cognitive-emotional patterns that require clinical intervention (Frost et al. 2012). Notably, research suggests that while acute pandemic hoarding behavior should not be considered pathological, prolonged cases may develop into clinically significant symptoms (Kirk and Rifkin 2020; Tse et al. 2022). The current study focuses specifically on hoarding behavior in response to a crisis (e.g., COVID-19).

Hoarding behavior leads to numerous adverse consequences across multiple levels. For individuals, it creates chaotic living spaces that significantly increase health risks and social isolation (Mayes et al. 2024). Socially, excessive hoarding behavior causes shortages and supply chain disruptions (Sodhi et al. 2023), potentially generating public agitation and further pandemic spread (Ahmed et al. 2021). Environmentally, hoarding behavior results in unused products that hinder recovery and recycling efforts, undermining sustainable development (Hou and Sarigöllü 2021). These significant impacts make it crucial to thoroughly explore the causes of hoarding behavior and develop effective mitigation strategies.

During the pandemic, research has identified several factors that can inhibit hoarding behavior. Increasing optimism about the pandemic helps reduce unethical behaviors like hoarding (Hou and Sarigöllü 2021), while enhancing emotional empathy for vulnerable populations promotes pro-social behaviors including hoarding avoidance (Pfattheicher et al. 2020). However, the potential role of mindfulness in inhibiting pandemic-related hoarding behavior remains unexplored, warranting further investigation, particularly in crisis contexts where shopping behaviors tend to intensify.

Mindfulness, defined as present-moment awareness (Brown and Ryan 2003), may serve as a protective factor against these maladaptive responses. As either a personality trait or skill

developed through meditation, mindfulness buffers stress and enhances coping with stressful events (Beshai et al. 2022). Since COVID-19's declaration as a pandemic, researchers have examined the benefits of mindfulness for personal adjustment (Beshai et al. 2022; Khezri Pour Gharai et al. 2023), finding significant correlations with favorable outcomes including reduced psychological distress and improved health behaviors (e.g., Hartstone and Medvedev 2021; Khezri Pour Gharai et al. 2023; Sun et al. 2022). Additionally, research has found that some risk factors generated by COVID-19 such as cognitive failures, intrusive thoughts and rumination can vary based on the mindfulness levels of individuals (Lopez et al. 2021).

Hoarding behavior (e.g., stockpiling essential goods) is linked to psychological inflexibility (Krafft et al. 2019; Ong et al. 2018). Research suggests this relationship may emerge when individuals become psychologically fused with thoughts about potential scarcity, leading to inflexible purchasing patterns as a means of regulating distress (Ong et al. 2018). Mindfulness, by contrast, appears to mitigate these effects by enhancing cognitive flexibility and reducing reactive decision-making (Hunsinger et al. 2019; Krafft et al. 2019). Additionally, mindfulness assists in regulating consumption desires and avoiding irrational behavior (Bharti et al. 2022; Tan et al. 2022). Preliminary evidence suggests a negative relationship between mindfulness and hoarding disorder (Gong et al. 2022), particularly regarding attention-related mindfulness aspects and hoarding symptoms among quarantined males (Marazziti et al. 2021).

Terror Management Theory (TMT; Greenberg et al. 1997) offers a theoretical framework to examine the mechanisms through which mindfulness influences hoarding behavior. TMT posits that people instinctively feel anxious when facing mortality due to their survival instinct and cognitive awareness of inevitable death (Greenberg et al. 1997). This death anxiety elicits negative emotional responses that motivate coping strategies to extend daily existence. TMT posits that individuals utilize defense mechanisms to mitigate death anxiety, with cultural worldviews and self-esteem functioning as primary protective factors (Greenberg et al. 1997). Subsequent research has discovered that the pursuit of and devotion to close relationship can also alleviate death anxiety (Lu et al. 2019). Moreover, TMT emphasizes the influence of death-related thoughts on daily behaviors, noting that most routine actions stem from unconscious mortality concerns (Hayes et al. 2010). Studies indicate consumers may cope with mortality salience through excessive consumption (Naomi and Dirk 2008), while reduced death anxiety correlates with decreased engagement in negative emotional behaviors like hoarding (Ahmed et al. 2021; Menzies and Dar-Nimrod 2017).

TMT suggests that death anxiety could serve as a mediator connecting mindfulness to hoarding behavior. Death anxiety, as an unpleasant emotion arising from the contemplation of mortality (Conte et al. 1982), may be better regulated by mindful individuals who tend to accept difficult emotions and respond consciously rather than habitually (Baer 2006). Moreover, people hoarded to cope with pandemic-related anxiety and fear, rationalizing it as a practical response to tangible risks (Ahmed et al. 2021). Existing research also confirms positive correlations between death anxiety and hoarding behavior (Menzies and Dar-Nimrod 2017). Thus, It suggests mindfulness may reduce hoarding behavior by lowering death anxiety.

Self-esteem and death anxiety may form a sequential mediation pathway linking mindfulness to hoarding behavior. Self-esteem reflects personal judgments about one's worth (Neiss et al. 2002), which mindfulness cultivates by reducing negative self-referential cognition (Shapiro et al. 2012). Empirical evidence demonstrates a positive correlation between mindfulness and self-esteem

(Bharti et al. 2022). As delineated in TMT, self-esteem defense is an important defense mechanism against death concerns (Hayes et al. 2010). Moreover, a reduction in death anxiety may be related to decreased hoarding behavior as a means to alleviate negative emotions (Menzies and Dar-Nimrod 2017). Theoretical analysis and previous findings indicate that self-esteem and death anxiety may sequentially mediate how mindfulness influences hoarding behavior.

Perceived social support and death anxiety may form another sequential mediation pathway linking mindfulness to hoarding behavior. Here, perceived social support is the subjective perception of receiving actual instrumental and/or emotional assistance from trusted partners, communities, and social networks (Lin 1986; Wilson et al. 2020). Mindfulness can cultivate college students to have present-moment awareness, enabling them to realize the social support they have obtained at present (Kuhl and Boyraz 2017; Wilson et al. 2020). According to the TMT, the pursuit of and devotion to close relationship can alleviate death anxiety (Lu et al. 2019). Social support represents a crucial component of intimate relationships that facilitates increased social connection and stronger interpersonal bonds (Feeney and Collins 2015). Close relationships offer people the opportunity to feel part of society and to feel connected to the world, thereby mitigating death concerns (Lu et al. 2019). Better-supported individuals more effectively regulate negative emotions (Gao et al. 2022), and lower death anxiety reduces hoarding behavior (Menzies and Dar-Nimrod 2017). Therefore, perceived social support and death anxiety likely operate as serial mediators between mindfulness and hoarding behavior.

Prior studies have preliminarily linked mindfulness to lower hoarding behavior (Gong et al. 2022; Marazziti et al. 2021), but the mechanisms remain unclear. Integrating TMT, we propose three pathways: (1) a simple mediation via reduced death anxiety, (2) a sequential mediation via increased self-esteem and reduced death anxiety, and (3) a sequential mediation via enhanced perceived social support and reduced death anxiety. These pathways align with TMT's emphasis on self-esteem and close relationships as existential defenses (Greenberg et al. 1997) and extend the research by identifying mindfulness as a potential antecedent of these protective factors.

This study examines Chinese college students, who face unique hoarding risks due to shared living spaces (Zhu and Geng 2023) and demonstrate worse hoarding symptoms than international peers (Timpano et al. 2015). Given that hoarding behavior may be exacerbated by existential anxiety during crises, we apply a TMT lens to explore how mindfulness mitigates such behavior in the context of COVID-19, thereby informing strategies for addressing public health emergencies. This study formulates a conceptual framework as shown in Fig. 1, and proposes the following hypotheses:

Hypothesis 1. Mindfulness is negatively related to hoarding behavior.

Hypothesis 2. Mindfulness is negatively related to hoarding behavior through decreased death anxiety.

Hypothesis 3. Mindfulness is negatively related to hoarding behavior through a sequential pathway involving increased self-esteem and subsequently decreased death anxiety.

Hypothesis 4. Mindfulness is negatively related to hoarding behavior through a sequential pathway involving increased perceived social support and subsequently decreased death anxiety.

Methods

Participants and procedure. In this research, the participants were students at various public universities located in Hunan, China. Questionnaires were created and distributed using the online survey tool, and participation was anonymous and voluntary. To reduce common method bias (e.g., Podsakoff et al. 2003; Turel and Osatuyi 2017; Wang and Jiang 2015), the study employed a two-wave data collection procedure in April 2022, with measurements taken one week apart during Hunan's COVID-19 outbreak. One week interval has been empirically validated in COVID-19 research (e.g., Schütz et al. 2021; Yang et al. 2022; Yonemitsu et al. 2020), and is consistent with intervals used to examine trait-related effects in similar studies (e.g., Bakker et al. 2021; Qi et al. 2023; Turel and Osatuyi 2017). Throughout the study period, regional epidemic-control measures, which included mandatory mask mandates, public space distancing protocols, and closures of educational and public institutions, remained in effect with varying intensity between timepoints. The university maintained minimal on-site staffing during both phases, with dormitories closed to students and all instruction delivered virtually.

At the first time point (T1), we distributed questionnaires to 1000 students. The questionnaires assessed demographic and control variables (e.g., age, gender, major, grade, family income, living expenses, and mindfulness training) as well as the predictor variable (mindfulness). Of the distributed questionnaires, 885 were returned the following day (88.5% response rate). At the one-week follow-up (T2), we emailed survey links to these 885 participants to assess outcome variables (self-esteem, perceived social support, death anxiety, and hoarding behavior). From this second wave, 540 responses were received, yielding a 61.02% response rate.

After excluding unmatched samples, questionnaires where respondents failed attention-check questions, obviously illogical responses, and excessive outliers across both time points, 310 valid questionnaires remained. As shown in Table 1, there were 310 students (210 women; $M = 20.86$, $SD = 1.43$) in the final sample, ranging from 16 to 26 years. The largest group, 38.91% of the participants were junior students, 36.13% were majoring in Science. Regarding monthly family income, the most common income bracket was between 3001 and 5000 RMB (about 411 to 685 USD), representing 36.45% of participants, closely followed

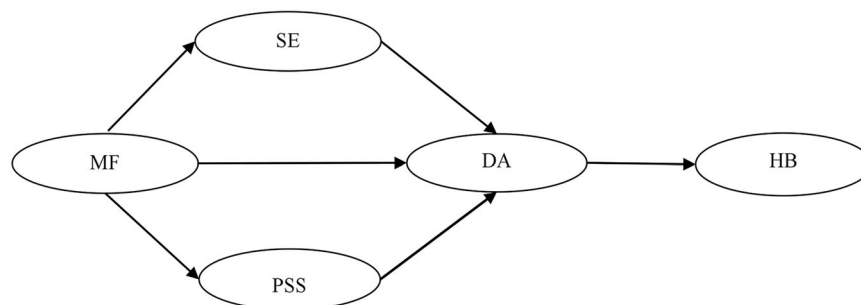


Fig. 1 Overview of the proposed multi-mediation model. MF mindfulness, SE self-esteem, PSS perceived social support, DA death anxiety, HB hoarding behavior.

Table 1 Demographic information of the respondents (N = 310).		
Variables	Frequency	Percentage
Gender		
Men	100	32.26
Women	210	67.74
Grade		
Grade 1	44	14.19
Grade 2	66	21.29
Grade 3	121	39.03
Grade 4	75	24.19
Graduate students	4	1.29
Major		
Arts	91	29.35
Science	112	36.13
Engineering	45	14.52
Others	62	20
Monthly family income (Unit: Yuan RMB)		
≤3000	42	13.55
3001-5000	113	36.45
5001-10,000	106	34.19
≥10,000	49	15.81
Monthly living expenses (Unit: Yuan RMB)		
≤1000	53	17.10
1001-1500	193	62.26
1501-2000	43	13.87
2001-2500	14	4.52
≥2500	7	2.26

by those with incomes ranging from 5001 to 10000 RMB (about 685 to 1369 USD).

Measurement of constructs

Independent variable: mindfulness. Mindfulness was determined using the 15-item Mindful Attention Awareness Scale (MAAS; Brown and Ryan 2003) at T1, assessing on a 6-point Likert scale from 1 for “almost never” up to 6 for “almost always”. It included items such as “I find it difficult to stay focused on what’s happening in the present”. All items were subsequently reverse-coded during analysis so that higher final scores indicate greater mindfulness. This scale have been used and verified in Chinese samples (e.g., Liu et al. 2024; Wang et al. 2022; Xie et al. 2021). The Cronbach’s α for the scale was 0.89.

Potential mediating variable: self-esteem. Self-esteem was assessed at T2 using the 10-item Rosenberg Self-Esteem Scale (RSES; Rosenberg 1965), with participants rating their agreement on a 6-point Likert scale from 1 for “strongly disagree” to 6 for “strongly agree”. A sample is “I take a positive attitude toward myself”. This scale have been used and verified in Chinese samples (e.g., Chen et al. 2021; Pan et al. 2024; Shi et al. 2022). The Cronbach’s α for the scale was 0.84.

Potential mediating variable: perceived social support. Perceived social support was measured at T2 with the Multidimensional Scale of Perceived Social Support (MSPSS; Zimet et al. 1988), a 12-item instrument employing a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree). It included items such as “My family really tries to help me”. This scale have been used and verified in Chinese samples (e.g., Cahuas et al. 2023; Ma and Lu 2024; Xu et al. 2024). The Cronbach’s α for the scale was 0.93.

Potential mediating variable: death anxiety. Death anxiety was determined using a 15-item Templer’s Death Anxiety Scale (T-

DAS; Templer 1970) at T2 on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). It included items such as “I am very much afraid to die”. This scale have been used and verified in Chinese samples (e.g., He et al. 2022; Yang et al. 2024; Yin et al. 2022). The Cronbach’s α for the scale was 0.77.

Dependent variable: hoarding behavior. Hoarding behavior during the COVID-19 pandemic was measured using a 5-item COVID-19 Induced Hoarding Intention (CIHI) scale derived from Sheu and Kuo (2020) at T2 on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). It included items such as “I will stockpile basic needs for my future consumptions amid the COVID-19 pandemic”. This scale, as evidenced in the study by Syahrivar et al. (2021), has proven to have great reliability and validity. The Cronbach’s α for the scale was 0.89.

Control variable: mindfulness training. In our study, we included the experience of participating in any mindfulness training (0 = No and 1 = Yes) as a statistical control variable, as previous studies demonstrated that mindfulness training affects the level of trait mindfulness (e.g., Alhawtmeh et al. 2022; Bharti et al. 2022; Stinson et al. 2024).

Data analysis. The study employed SPSS 24.0 and AMOS 24.0 for statistical analyses. The model fit was evaluated based on four widely recognized goodness-of-fit criteria (Arbuckle 2016; Hu and Bentler 1999). The chi-square to degrees of freedom ratio (χ^2/df) was required to be below 5, while the Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) needed to exceed 0.90 to indicate good fit. Additionally, the Root Mean Square Error of Approximation (RMSEA) values below 0.08 were considered acceptable. However, given that the significance of chi-square becomes overly sensitive with larger sample sizes (particularly exceeding 200 cases), frequently rejecting theoretically sound models (e.g., Kline 2015; Meade et al. 2008; Windsor and Anstey 2010), we did not use the statistical significance of the chi-square value for assessing overall model fit.

This study employed dimensional scores for multidimensional scales and created item parcels using the item-to-construct balance approach for unidimensional scales to generate measurement indicators (Little et al. 2002; Zheng et al. 2019). For the multidimensional perceived social support scale, we applied the internal-consistency approach (Wu and Wen 2011), averaging items within each subscale to create three distinct parcels representing each support dimension. For unidimensional scales (mindfulness, self-esteem, and death anxiety), we implemented the item-to-construct balance approach. This involved conducting factor analyses, sorting items by their factor loadings, and strategically grouping items with similar loadings to create balanced parcels (Wu and Wen 2011; Yang et al. 2010). Through this procedure, the 15 mindfulness items were parceled into 3 indicators, the 10 self-esteem items into 2 indicators, and the 15 death anxiety items into 3 indicators. Hoarding behavior was defined using the items because it consisted of only five items.

We implemented the conventional two-step analytic sequence by first establishing the measurement model through confirmatory factor analysis, then subsequently examining the structural model posited in our hypotheses. In the formulated structural model, mindfulness was positioned as the latent independent variable, with self-esteem, perceived social support, and death anxiety serving as latent mediating variables, and hoarding behavior as the latent dependent variable. After conducting the path analysis, in order to rigorously test the indirect effect, we employed a bootstrapping approach with 5,000 resamples to generate bias-corrected 95% confidence intervals.

Table 2 Means, standard deviations and correlations among study variables.									
Variables	M	SD	CR	AVE	1	2	3	4	5
1. Mindfulness	3.80	0.84	0.89	0.74	0.86				
2. Self-esteem	3.96	0.73	0.89	0.80	0.36***	0.89			
3. Perceived Social Support	4.80	0.96	0.86	0.68	0.21***	0.41***	0.82		
4. Death Anxiety	3.18	0.52	0.82	0.61	−0.28**	−0.31***	−0.27***	0.78	
5. Hoarding Behavior	3.54	0.79	0.89	0.62	−0.24**	−0.17**	0.08	0.19***	0.79

Values on the diagonal represent the square root of average variance extracted (AVE). Off-diagonal elements are inter-construct correlations.
** $p < 0.01$; *** $p < 0.001$.

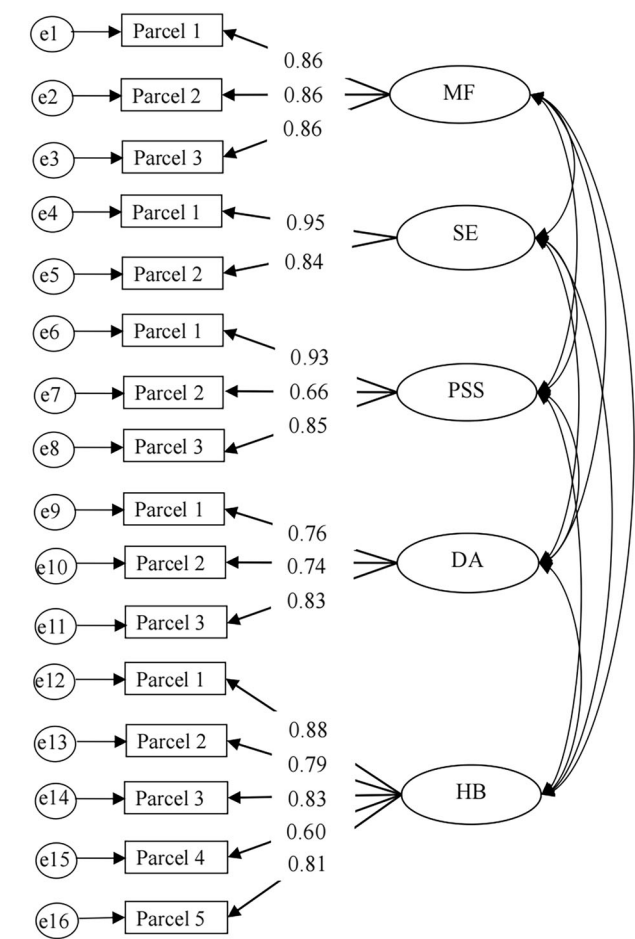


Fig. 2 Standardized factor loadings of each parcel on latent constructs. MF mindfulness, SE self-esteem, PSS perceived social support, DA death anxiety, HB hoarding behavior.

Table 3 Results of total and indirect effects (5000 bootstraps).				
Path	Effect	SE	95% LLCI	95% ULCI
Total effect				
MF → HB	−0.09	0.04	−0.17	−0.03
Indirect effect				
MF → DA → HB	−0.06	0.03	−0.12	−0.02
MF → SE → DA → HB	−0.02	0.01	−0.06	−0.01
MF → PSS → DA → HB	−0.01	0.01	−0.02	−0.002

MF mindfulness, SE self-esteem, PSS perceived social support, DA death anxiety, HB hoarding behavior.

Results
Preliminary analysis. Table 2 presents the descriptive statistics (means and standard deviations) and bivariate correlations for all study variables. This initial evidence underscores the potential relationships hypothesized in our study and sets the foundation for further analysis.

Confirmatory factor analysis (CFA). The CFA results revealed that the proposed five-factor model demonstrated a good fit to the data: $\chi^2/df = 1.354$; CFI = 0.988; TLI = 0.984; RMSEA = 0.034. Figure 2 displays the standardized factor loadings, all of which demonstrated statistical significance ($p < 0.001$). The obtained values ranged from 0.60 to 0.95, surpassing the conventional threshold of 0.50. Additionally, AVE values presented in Table 2 showed a variation from 0.61 to 0.80, while the CR values fell within the range of 0.82–0.89. Moreover, the square roots of AVE varied from 0.78 to 0.89, all of which were consistently greater than the corresponding inter-construct correlations, thus satisfying the discriminant validity criteria. The HTMT analysis also indicated that the correlation values between constructs were below the threshold of 0.85. These findings confirm that the measurement instruments employed in this study exhibit satisfactory levels of both convergent and discriminant validity.

Hypothesis testing. The findings of the SEM analysis indicated a good fit for the model: $\chi^2/df = 1.782$, CFI = 0.969, TLI = 0.961, RMSEA = 0.05.

H1 posited a negative correlation between mindfulness and hoarding behavior. As shown in Table 3, bootstrapping analyses indicated a significant negative total effect of mindfulness on hoarding behavior ($effect = -0.09$, $p < 0.001$, $95\%CI = [-0.17, -0.03]$), supporting H1.

H2 posited a negative association between mindfulness and hoarding behavior, mediated by lower death anxiety. The SEM results depicted in Fig. 3 showed that mindfulness negatively correlated with death anxiety ($B = -0.15$, $\beta = -0.24$, $p < 0.01$). Additionally, there was a positive association between death anxiety and hoarding behavior ($B = 0.39$, $\beta = 0.23$, $p < 0.001$). Table 3 presents further analysis using a bootstrapping procedure, which reveals a significant and negative indirect impact of mindfulness on hoarding behavior, mediated by a decrease in death anxiety ($effect = -0.06$, $p < 0.001$, $95\%CI = [-0.12, -0.02]$). Therefore, H2 was supported.

H3 posited a negative association between mindfulness and hoarding behavior, mediated by higher self-esteem and lower death anxiety. The SEM results depicted in Fig. 3 indicate a positive association between mindfulness and self-esteem ($B = 0.40$, $\beta = 0.43$, $p < 0.001$). Additionally, self-esteem was found to be negatively associated with death anxiety ($B = -0.15$, $\beta = -0.22$, $p < 0.01$), while death anxiety positively correlated with hoarding behavior ($B = 0.39$, $\beta = 0.23$, $p < 0.001$).

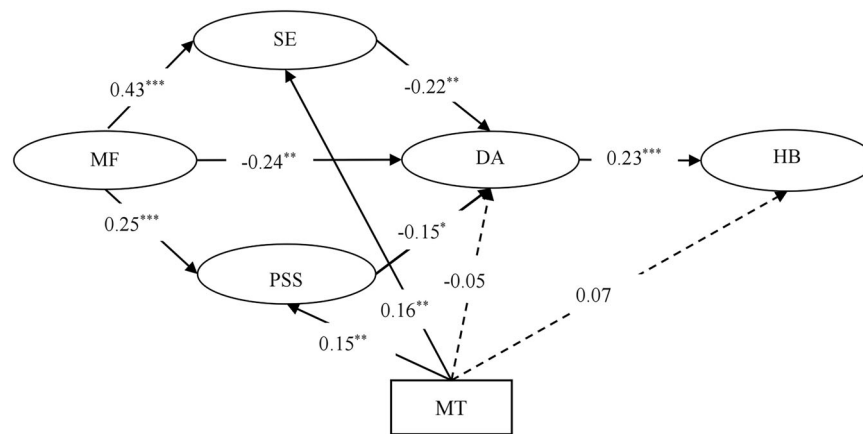


Fig. 3 Results of structural equation modeling (N = 310). MF mindfulness, SE self-esteem, PSS perceived social support, DA death anxiety, HB hoarding behavior, MT mindfulness training. The effects of mindfulness training was controlled. All coefficients are standardized. The solid line indicates a significant path, while the dashed line indicates a non-significant path. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 3 presents further analysis using a bootstrapping procedure, which reveals that the indirect effect of mindfulness on hoarding behavior, mediated sequentially through an increase in self-esteem and a decrease in death anxiety, was significant and negative ($effect = -0.02$, $p < 0.01$, $95\%CI = [-0.06, -0.01]$). Hence, H3 was supported.

H4 posited a negative association between mindfulness and hoarding behavior, mediated by higher perceived social support and lower death anxiety. The SEM results depicted in Fig. 3 revealed that mindfulness was positively related to perceived social support ($B = 0.33$, $\beta = 0.25$, $p < 0.001$). Additionally, perceived social support was negatively correlated with death anxiety ($B = -0.07$, $\beta = -0.15$, $p < 0.05$), while death anxiety had a positive correlation with hoarding behavior ($B = 0.39$, $\beta = 0.23$, $p < 0.001$). Table 3 presents further analysis using a bootstrapping procedure, which reveals that the indirect effect of mindfulness on hoarding behavior, mediated sequentially through an increase in perceived social support and a decrease in death anxiety, was significant and negative ($effect = -0.01$, $p < 0.01$, $95\%CI = [-0.02, -0.002]$). Hence, H4 was supported.

Discussion

Drawing from the TMT, this study demonstrates that college students possessing greater mindfulness tend to engage less in hoarding behavior amid the pandemic. It uncovered three distinct mediating pathways: a simple mediation through decreased death anxiety, a sequential mediation through increased self-esteem and decreased death anxiety, and another sequential mediation through increased perceived social support and decreased death anxiety. This research contributes to the body of knowledge by introducing a conceptual framework that illustrates a critical psychological factor, namely mindfulness, can promote self-esteem or perceived social support, thereby reducing college students' death anxiety and, ultimately, hoarding behavior. By applying TMT to examine mindfulness and hoarding behavior, this study identifies potential psychological mechanisms underlying this relationship. The results may enhance understanding of hoarding behavior among college students while extending applications of TMT to crisis-related consumption. Future research with multi-wave longitudinal and experimental designs could more rigorously test these theoretical propositions.

Theoretical implications. These empirical outcomes offer valuable theoretical insights. First, this preliminary investigation provides initial evidence of a negative relationship between

mindfulness and hoarding behavior in the specific context of a two-wave survey during the pandemic. Our findings offer a potentially valuable perspective for understanding this relationship during the COVID-19 pandemic, while extend the understanding of benefits of mindfulness from the perspective of TMT by demonstrating its potential applicability to crisis-related behaviors (e.g., Analayo et al. 2022; Niemiec et al. 2010; Park and Pyszczynski 2019), and expand our understanding of individual differences in hoarding behavior during the pandemic (e.g., Broos et al. 2024; Sun et al. 2025; Yoshino et al. 2021).

Second, our research explores the mediating roles of self-esteem, perceived social support, and death anxiety in the observed mindfulness-hoarding relationship during the pandemic. The findings elucidate a novel understanding of mindfulness-based protective factors against pandemic hoarding behavior by identifying three distinct psychological pathways. As an advanced empirical investigation of these underlying mechanisms, the research demonstrates that mindfulness may yield multiple benefits in behavioral regulation during crises. Our findings unpack the psychological “black box” between mindfulness and hoarding, identifying self-esteem, perceived social support, and death anxiety as key mediators within the TMT framework.

Third, the findings of this research lend support to the TMT proposed by Greenberg et al. (1997). By applying TMT, we develop an explanation for why mindfulness shows negative correlation with hoarding behavior in contexts where crisis-related shopping behaviors are likely to intensify. These results demonstrate the potential utility of applying this theoretical framework to understand pandemic-related hoarding behavior. They hold heuristic value for advancing studies in TMT (e.g., Analayo et al. 2022; Bodner et al. 2023; Park and Pyszczynski 2019) while providing novel perspectives for understanding mindfulness applications in health crisis contexts (e.g., Beshai et al. 2022; Khezri Pour Gharaei et al. 2023; Mak et al. 2023).

Practical implications. The findings possess significant potential for practical use. First, this study found that college students who possess a greater level of mindfulness exhibit less death anxiety and hoarding behaviors. Although excessive hoarding behavior during health crises may represent an adaptive response, healthcare practitioners should nevertheless monitor for pathological manifestations. If such purchasing habits persist or escalate into chronic compulsions, where accumulating and retaining items disrupt daily life, intervention may be necessary (Tse et al.

2022). Further investigation should verify these findings and determine whether changing mindfulness results in changes in hoarding behavior during disasters. Promoting mindfulness broadly and cultivating mindfulness as a habitual practice may help college students avoid excessive hoarding behavior even in the face of death anxiety during the health crisis.

Second, hoarding behavior will make enterprises profit in the short term, but it may overdraft the purchasing power of consumers in the future on similar products, this trend can be detrimental to the sustainable, long-term growth of these enterprises (Gong et al. 2022; Tan et al. 2022). Our results suggest that marketers can consider using a brief mindfulness meditation to help consumers reduce hoarding behavior. Promoting mindfulness may be effectively curtail irrational consumption (Tan et al. 2022), thereby enhancing customer relationship management.

Third, considering the adverse effect of hoarding behavior on society and the environment (e.g., Hou and Sarigöllü 2021; Mayes et al. 2024; Sodhi et al. 2023), integrating mindfulness practices into ethical education interventions may be a critical measure in advancing sustainable development. Educational institutions should not only integrate mindfulness into their curriculum but also emphasize its importance in cultivating rational consumption behaviors among students (Gupta and Verma 2020). Several interventions incorporating mindfulness components, such as Acceptance and Commitment Therapy (ACT), have demonstrated efficacy in ameliorating hoarding symptoms (Krafft et al. 2023). A variety of mindfulness-based interventions may be developed by school social workers and practitioners in accordance with the clinical presentation of the student and the program resources. Furthermore, this study underscores the need for enhanced social support during the health crisis. Governments and social organizations should provide targeted guidance and resources during the health crisis, such as distributing essential supplies and establishing hotline for epidemic-related assistance.

Limitations and future directions. Current research is subject to specific limitations, which provide opportunities for future studies. First, although the two-wave design with a one-week interval used in current investigation improved upon cross-sectional designs (common in mindfulness studies, e.g., Beshai et al. 2022; Gong et al. 2022; Zipagan and Galvez Tan 2023, and hoarding studies, e.g., Gong et al. 2022; Oglesby et al. 2013; Sun et al. 2025) by separating predictor and outcome measurements, it shares limitations with cross-sectional designs, such as measuring each construct only once. Future research should employ experiments or multi-wave designs with repeated measurements of all constructs across at least three time points to establish causal relationships and enhance the predictive strength of the proposed multi-mediation model.

Second, while current research examined hoarding behavior specific to the COVID-19 pandemic, we did not assess clinical symptoms of hoarding disorder. Although pandemic-related hoarding behavior may share behavioral similarities with hoarding disorder (e.g., excessive accumulation), the motivations and severity likely differ (Frost et al. 2012; Kirk and Rifkin 2020; Timpano et al. 2015). Nevertheless, although hoarding behavior during crises should be distinguished from pathological hoarding disorder, clinicians must vigilantly track whether behaviors evolve into persistent, functionally impairing compulsions (Tse et al. 2022). Future studies should include validated measures of hoarding disorder (e.g., the Saving Inventory-Revised) to distinguish between situational and pathological hoarding, particularly in high-stress contexts.

Third, this study found three mediators of mindfulness affecting hoarding behavior, but its boundary conditions were not discussed. It is likely that self-efficacy may moderate the relationship verified in our study. Research suggests that

individuals with greater self-efficacy tend to exhibit higher self-esteem (Awick et al. 2017). Besides, individuals with lower self-efficacy were shown to have a greater tendency to express more death anxiety (Tang et al. 2002). Thus, future studies can further examine the possible moderating role of self-efficacy in the relationship verified in our study.

Fourth, the survey was distributed only to college students in China. Differences in cultural background can influence social and psychological responses during a crisis (Lu et al. 2024). Moreover, the dependence degree of consumers on mindfulness and social support in different cultural environments may be influenced by cultural orientation. Eastern countries place more emphasis on mindfulness because of the Buddhist tradition (Burke et al. 2017), and collectivist cultural societies (e.g., China) tend to rely more on social support than individualistic cultural societies (e.g., the United States) (Szkody et al. 2024). Extending research to diverse age groups and cultural backgrounds would provide deeper insights into how mindfulness influences hoarding behavior.

Conclusion

The current study elucidates the mediating pathways connecting mindfulness to hoarding behavior among college students, employing TMT as its theoretical framework. The findings reveal that mindfulness is inversely related to hoarding behaviors during the pandemic, a relationship that is mediated through three distinct paths: a direct mediation by death anxiety, a sequential mediation via an increase in self-esteem leading to a decrease in death anxiety, and another sequential mediation through an increase in perceived social support followed by a reduction in death anxiety. These insights not only augment the body of knowledge on mindfulness and hoarding behavior but also shed light on the complex interactions between self-esteem, perceived social support, and death anxiety in modulating the mindfulness-hoarding dynamic amidst health crises such as pandemics.

Data availability

Study data are available from the corresponding author upon request.

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Author contributions

Yuxuan Tan: conceptualization, investigation, methodology, formal analysis, funding acquisition, writing—original draft, writing—review & editing. Rong Huang: conceptualization, investigation, funding acquisition, writing—review & editing. Ying Sun: conceptualization, formal analysis, writing—review & editing.

Competing interests

The authors declare no competing interests.

Ethical approval

The research reported in this article was conducted following the ethical guidelines of Business School of Central South University. Ethical approval was obtained from the Institutional Review Board of Business School of Central South University on April 19, 2022. There was no specific approval number attached to the approval. It adheres strictly to ethical standards aimed at safeguarding the rights of human participants, including privacy, confidentiality, informed consent, dignity, protection, and voluntary participation. All processes and procedures followed in this research align with the ethical principles outlined in the Declaration of Helsinki (1964). This approval covers every aspect of the study, such as participant recruitment, data collection and analysis, informed consent procedures, and measures to ensure confidentiality, as specified in the approved protocol.

Informed consent

Data collection commenced in April 2022, with all participants giving implied informed consent through an online process prior to their involvement. The research team conducted the sessions throughout April 2022, ensuring that ethical standards were strictly followed and informed consent was obtained at the outset of each session. They were presented with detailed information about key aspects of the research, including: (1) confidentiality, which ensured that personal information would remain private and would not be disclosed or published, and (2) data usage, specifying that all collected data would solely serve academic research purposes without any commercial applications. To participate in the study, participants were required to indicate their understanding and agreement by clicking the “agree and continue” button, which granted them access to the questionnaires.

Additional information

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