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Abstract

The outbreak of the COVID-19 pandemic and the spread of deadly virus globally compels individuals to reevaluate death and dying, and this forced awareness of death influences adaptation to a changing environment. Several studies have employed artificial laboratory settings of mortality salience or subliminal death primes to increase mortality awareness and mortality threat perception. However, few studies have used natural settings to activate a larger ecological network of perceived mortality threats. To understand such natural environment conditions under which individuals feel most fearful for their safety and lives, the goal of this study is to examine whether changes in overall fear of death varied according to individual distinctions in life history (LH) strategy and current environmental status under the COVID-19 pandemic. Residents of Hubei, China (N = 202) reported their fear of death subject scores once during and once after the mandatory lockdown period. The results revealed that LH was associated with fear of death, and the current environment moderated this association, suggesting that slow LH strategy was predictive of more intense death fear at lower levels of mortality threat in a given environment than at higher levels of this threat.

Keywords: life history; death fear; unpredictable environment; COVID-19 pandemic, mortality threat

Public significance of the study: "In the present study, we compared individual differences in life-history behavioural and cognitive profiles in influencing death fear during the COVID-19 pandemic. We explored the moderating role of environmental unpredictability in the relationship between fear of death and LH during and after compulsory lockdown. This study employed natural environments to activate a more comprehensive network of death-related concepts as the global spread of the virus progresses."

Introduction

Since early 2020, Coronavirus disease (COVID-19) rapidly spread across multiple continents and populations, overwhelming the public health systems and affecting nearly every aspect of human life. At some point during the ongoing pandemic, in which mortality has been made salient nearly constantly, every person will encounter threats to their survival in some manner, with some individuals witnessing others facing death and the dying process. From an evolutionary perspective, a fundamental predicament faced by all living organisms is the successful allocation of time, energy, and resources among the various tasks associated with survival (Griskevicius, 2011). According to recent life history (LH) theory research, humans tend to adopt various LH strategies depending on variations in ecological factors such as environmental harshness (e.g., age-specific mortality and morbidity rate; Ellis et al., 2009), environmental unpredictability (e.g., harshness constancy from one period to another; Stearns, 1992). LH trade-offs on the fast and slow continuum are contingent on how individuals acquire energy and optimize resource expenditure under environmental risk and mortality threats. An abundant body of research has investigated the link between mortality threats and LH strategy and explored how LH strategy and its orientations are expressed when triggered by mortality salience or awareness of one's mortality (Burger et al., 2012). Despite the growing number of studies focusing on the interaction between LH and its manifestations to jointly affect psychological responses as individuals confront the extrinsic mortality risks (Ellis et al., 2009; Mittal & Griskevicius, 2014), there is a lack of research encompassing a change in environmental circumstances in relation fear-based responses and life history strategy. The COVID-19 pandemic offers unprecedented insights into the dynamics of our everyday environments that can create viable paths for individuals' mortality threat perception. Previous death-related studies have focused on highly personal and reflexive investigations (e.g., Bowtell et al., 2013; Woodthorpe, 2007), end-of-life care (e.g., Barnett, 2001), phenomenological suicide research (e.g., Boden et al. 2016), theoretical underpinnings (e.g., Kübler-Ross,1969; Walter, 1994), and the experimental application of mortality salience primes (Griskevicius et al., 2011; Mittal & Griskevicius, 2014). This research will address the research gap in a micro-focus on individual differences in processing mortality cues by offering the new evolutionary perspective in LH. Expanding on earlier research and addressing these research gaps, this study centers on how individuals' LH strategy and current environments affect fear of death and delineates the evolutionary logic underlying these dynamics.

LH Theory on Individuals' Variations in Response to Mortality Threat

The starting point of LH theory is the assumption that time and resources are inherently limited, so organisms have to decide how to invest in optimizing their fitness within different environmental constraints (Kaplan & Gangestad, 2005). LH theory seeks to explain how natural selection and other evolutionary forces shape organisms to optimize their survival and reproduction in facing ecological challenges posed by their environments (Stearns, 1992). This theory suggests that an individual adjusts to environmental stressors in an adaptive manner in early environments (e.g., Belsky et al., 1991; Mittal et al., 2015; Nettle, 2010). Notably, individuals' early childhood stressors could interact with current environmental cues that calibrate LH strategy (Kaplan & Gangestad, 2005; Griskevicius et al., 2012). A potentially fatal disease outbreak is a potent environmental signal that establishes selection pressures for most living organisms, including humans that use these environmental signals adaptively to choose developmental paths on a continuum—from slower LH strategies that focus on longer-term goals to faster LH strategies that focus on more immediate payoffs (Chisholm et al., 1993; Griskevicius et al., 2012). Under extensions of the LH theory framework, a broader suite of motivational and attitudinal LH traits could elucidate individual differences in managing fear of death during highly unpredictable times, such as the COVID-19 pandemic. As uncertainty lingered during the pandemic and lockdown, cognitive and behavioral manifestations of fast–slow LH strategy were associated with the perception of risky and unpredictable current environments that may also have influenced emotional reactions such as fear to various extents.

In a general unpredictable environment with substantial mortality threat, an individual with slow LH, compared with individuals with fast LH, may experience more intense fear of death because of the perception of an uncertain future. Particularly, during relatively peaceful times, such as periods free of natural disasters or potentially fatal viruses, slow-LH individuals may express a greater fear of death because of the possible interruption of their long-term plans. Compared with fast-LH individuals, slow-LH individuals require greater ecological and social stability to formulate the optimal adaptive strategies (Gladden et al., 2009). As future-oriented and long-term planners, slow-LH individuals might express more worries regarding the future when their current environment is considerably dangerous and unpredictable. Slow-LH individuals' cognitive and behavioral manifestations involve inclinations to preserve life; conserve energy; maintain affiliative, cooperative, and altruistic relationships with important others (Chang et al., 2019); exercise caution; gain control; execute long-term plans; and avoid risk (Del Giudice & Belsky, 2010). Under the social and emotional toll caused by unpredictable environments, individuals require substantially more effort to remain safe. This may generate heightened anxiety regarding unaccomplished long-term goals and plans, coupled with uncertainty about the future. On the other hand, fast-LH individuals may experience less worry and anxiety when facing general unpredictable environments compared with COVID-related environmental difficulties. Faster LH strategy is more adaptive when the future is uncertain or when mortality and morbidity rates are high (Bereczkei & Csanaky, 2001), and is more beneficial in risky, resource-limited, and unpredictable environments (Miller & Rucas, 2012). Moreover, in dangerous, changeable environments, fast LH manifestations are intrinsically favored because outcomes are considerably more uncertain (Mittal et al., 2015). The cognitive and behavioral manifestations of fast-LH individuals include less risk aversion, a focus on the present, an inclination toward immediate gains, and manifestations of impulsivity (Chen & Chang, 2016), boldness, or risk-taking orientations (Copping et al., 2013). These contingent expressions of fast LH strategy might be adaptive in discounting potential future losses and mitigating current stresses and anxiety.

Nonetheless, slow LH manifestations may become a buffering factor to mitigate death fear during lockdown. The mandatory mobility restrictions required by lockdown policies include social distancing and self-quarantine, which have led people to avoid public gatherings, forcing some individuals to rely on their household or family members for their sense of overall social connection (Lu el al., 2021; Okabe-Miyamoto et al., 2020). Individuals who adopt slower LH strategies may previously have more stable relationships, whether with families, romantic partners, or friends, than those who adopt faster LH strategies (Del Giudice & Belsky, 2010). As they face the threat of death during a pandemic and the accompanying lockdown, slow-LH individuals may exhibit relatively less fear compared with the level they may experience during a normal period because of the social support they receive from family, friends, and close social relationships. Thus, either face-to-face or remote support may help them endure relentlessly challenging situations. Additionally, due to the inclination of future-oriented perspectives, slow individuals may show less antagonistic and resistant to, various disease control and public health measures (Chang et al., 2021). Unlike slow individuals who are inclined to affiliative, cooperated and altruistic sociality that is mindful of future cooperation and long-term reciprocation, fast individuals who are characterized by antagonistic and utilitarian social interactional style, aimed at serving immediate and self-focused needs (Chang et al., 2021). Thus, for many fast LH strategists, COVID-19 pandemic and mandatory lockdown may create a void in personal contacts and self-isolation for some people who live alone (Banerjee & Rai, 2020) and for those who may be lacking close social connections. Fast strategists are therefore expected to demonstrate increasing pandemic-increased fear compared to normal period. Accordingly, the adverse influence of an individual's current environment regulates the individual's adaptive psychological responses such as fear regarding unexpected mortality threats. As increasing deaths due to COVID-19, which is highly contagious, an adaptive response to fear is fundamental in preparation for the survival of potential threat events (Ornell et al., 2020), for both LH groups during lockdown.

Moderating Role of the Current Environment

LH theory have identified extrinsic mortality–morbidity (i.e., all unpreventable sources of mortality), intrinsic component of mortality risk (i.e., mortality-causing threats that an organism has some control in overcoming), and unpredictability (i.e., the extent to which individuals cannot predict future events) as the key dimensions that calibrate LH manifestations (Ellis et al., 2009; Stearns, 1992). Most pathogen stress and infectious diseases (e.g., the COVID-19 pandemic) represent intrinsic risks because they do not cause species-wide adult mortalities, instead, these risks are differentially tolerated or resisted by individuals that lead to individual differences in disease susceptibility or defensibility (Lu et al., 2021; Schmid-Hempel, 2003). Because of the perception of environmental unpredictability during the COVID-19 pandemic, individuals might continually monitor their environments' specific features or mortality cues (e.g., death counts, regional mortality rates, and infection rate) that could sensitize their LH strategy. Rather than being anchored for life, LH strategy shows environmental contingency in response to particular types of mortality cues during adulthood (Nettle et al., 2013). The pandemic exerts a strong adverse impact on individuals' lives; high transmission and mortality rates, compounded by a lack of effective prevention and treatment measures, reinforce perceptions of the threat of death and environmental unpredictability. The strictest disease control measures were initially applied in Wuhan and subsequently in other Hubei municipalities, with a complete lockdown of the entire population beginning in late January 2020. Hubei's lockdowns created a strong sense of mortality salience (with extremely high threat of death levels surrounding nearby communities) that could exert a stronger influence on the relationship between LH and the fear of death. Thus, previous LH manifestations would become less decisively calibrated. Furthermore, the COVID-19 pandemic may have encouraged individuals to behave in a more guarded manner because of behavioral and motivational controls ranging from social distancing and self-quarantine to compulsory lockdowns (Melnick & Ioannidis, 2020). Slow-LH individuals may acclimate to such behavioral controls because these social prescriptions and those of other organized disease control policies tend to favor behaviors that better characterize the slower side of the LH strategy (Sherman et al., 2013). Thus, slow-LH individuals may exhibit less anxiety concerning mobility controls compared to fast-LH individuals, and the intensity of fear of death experienced during lockdown may be influenced by both the current environmental status and LH.

The perception of environmental data from mortality rate sources and the processing of this mortality salience may interact with individuals' LH strategy and influence their fear intensity as an adaptive psychological response to current environmental threats. Research examining the interaction between mortality salience with regard to the current external environment and emotional and cognitive responses associated with LH has primarily used priming to activate environmental cues. Mortality salience has been established to affect attitude and decision-making through various means. For example, Griskevicius et al. (2011) demonstrated that an individual establishes a particular LH strategy during early childhood, but this strategy may manifest only when triggered by an environmental challenge—in this case, a mortality salience prime. Mittal and Griskevicius (2014) indicated that individual distinctions associated with early unpredictable or uncertain environments are often contingent on environmental contexts later in life. For example, college students with lower socioeconomic status (SES) tend to take more risks and behave more impulsively after mortality priming. However, studies have employed only artificial subliminal presentations of death-related cues that led to augmented death-thought accessibility. Therefore, studies applying natural death-related cues should be conducted. Similar to experimental studies that have investigated attitude and decision-making using a mortality prime to create awareness of one's mortality (e.g., Pyszcynski et al., 2004; Rosenblatt et al., 1989), the COVID-19 pandemic may activate a more comprehensive network of death-related concepts as the global spread of the virus progresses. Herein, to avoid the artificial effect of mortality salience priming, natural environments were employed. After more than one year of pandemic navigation, residents in Hubei have been released from lockdowns and travel restrictions. After the compulsory lockdown, the effective implementation of comprehensive control measures and infection-treatment practices has led the infection and mortality rates in Hubei decline continuously (Zhang et al., 2020). We plan to construct a second-wave assessment tool to measure Hubei residents' fear of death in April 2021 when no new cases and deaths were confirmed. The present study answered the next-step question of the joint effect of LH and external environment (during versus after lockdown) in influencing fear of death and dying.

Present Study

Considering this pandemic background, the present study aimed at testing the principal effects of extreme current environmental unpredictability during and after the COVID-19 lockdown and LH strategy, respectively, as well as the interaction between these two factors in relation to the fear of death. More in detail, we postulated that LH in predicting the fear of death would differ for environmental status during versus after lockdown. We tested the following hypotheses: (a) Individuals adopting slower LH strategies would experience a heightened fear of death compared with individuals adopting faster LH strategies in a relatively peaceful environment (after lockdown); (b) Under extremely high mortality threats during the pandemic and lockdown, individuals' current external environment would moderate the relationship between individuals' LH strategy and fear of death; (c) We predicted a significant disordinal interaction between LH and current environment. In particular, slow LH behavioral and cognitive profiles during lockdown may play a buffering role.

Method

Sample Selection and Data Collection

We administered two web surveys from 2020 to 2021 in accordance with the indication that data collected from the Internet can be reliable and valid (Gosling et al., 2004). The snowball sampling method (Fricker, 2008) was used to recruit participants from the general population in Hubei province through personal invitations or materials advertised via social media platforms. Because of the COVID-19 pandemic, participants were recruited randomly online from Hubei Province during the lockdown from late January to early April 2020. The surveys, which were in Chinese, were collected in two waves 12 months apart. All participants provided informed consent, completed the surveys online, and were assured that their responses would remain confidential and be used solely for research purposes. Individuals who refused to provide consent or were unable to complete the surveys were excluded. The first survey was completed during the COVID-19 lockdown (Time 1; March 2020), and the second survey was completed after the COVID-19 lockdown (Time 2; April 2021). Of the 267 participants from Time 1, 202 completed both surveys and satisfied our inclusion criterion of current Hubei residency. In total, 65 participants were excluded from

Time 2. Our study protocol was approved by the institutional review board of the authors' affiliated university.

Demographic Characteristics

Participants were asked to provide their demographic data with self-constructed items of gender, age, residency, marital status, employment status, education level, and household income (Table 1). The participants were aged 14–54 years (*M* = 30.58, standard deviation [*SD*] = 7.53), and 89 (44.06%) were women. In total, 94 of the 202 participants (46.53%) were Wuhan residents, and 108 (53.47%) were residents of other Hubei municipalities. A total of 156 (77.23%) of the participants were currently employed or self-employed, 136 (67.33%) were married, and most (n = 151) had a bachelor's degree or higher.

Measures

Fear of Death

Fear of death experienced during the lockdown was measured using the Multidimensional Orientation Toward Dying and Death Inventory (MODDI-F), which has a five-factor feature dimension: fear of one's own death (e.g., 'I am frightened by the idea that all my thoughts and feelings will stop when I am dead'); fear of corpses (e.g., 'The thought of the coldness of a corpse terrifies me'); fear of one's own dying process (e.g., 'The thought that my dying could be long and painful is unbearable to me'); fear of another person's death (e.g., 'I am afraid of losing loved ones through death'), and fear of another person's dying process (e.g., 'I am afraid of having to support another person someday when he or she is dying'). Items are rated on a 7-point Likert scale (1 = very strongly disagree; 7 = very strongly agree), with higher scores indicating greater fear of death. The alpha coefficient of the results ranged from .82 to .92, meeting the standard for internal consistency reliability.

Mini-K Scheme

The participants completed 20-item scale measuring LH strategy's behavioral and cognitive aspects on a single continuum in the direction of slow LH (Figueredo et al., 2006). The items were rated on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree). Higher values indicate the presence of a greater inclination of slow LH traits and vice versa. The estimated internal consistency reliability of the results was .77, meeting the standard for internal consistency reliability.

Time 1

Between March 3, 2020 and the end of March 2020, 267 participants completed the MODDI-F, Mini-K Scheme and demographic queries.

Time 2

We invited participants who had participated in the Time 1 survey to complete a second survey between April 2 and April 18, 2021. The Time 2 survey contained the same MODDI-F and Mini-K scheme questions. The data of 65 of the 267 participants were excluded from further analysis either because they failed to complete the Time 2 survey or because they had moved from Hubei.

Current Environment (During vs. After Lockdown)

On both the Time 1 and Time 2 surveys, participants were asked whether they were currently in compulsory lockdown or self-quarantine in Hubei. For consistency with lockdown status, we included only participants who completed the survey on or before the date the compulsory lockdown was lifted at Time 1 (April 26, 2020). While at Time 2, all participants in Hubei were free to travel. The item was coded as a binary variable (1 = during lockdown; 0 = after lockdown).

Data Analytic Strategy

All analyses were performed with the R statistical software system in version 3.5.3 (R Core Team, 2016), using library "lme4" (Bates et al., 2011). Preliminarily, a multivariate multiple regression analysis was performed to exclude the potential confounding effects of the following variables (covariates): age, gender, marital status and education level. Thus, external variables were simultaneously regressed on all the aforementioned demographic variables. Slow-versus-fast LH differences on death fear were tested using t-tests. Answering ecologically valid paradigm often requires a clustering data with multiple predictors for a response variable of interest, because observations uniquely belong to particular groups that might arise from repeated measurements on the same individuals in a time series (Zuur et al. 2009). A linear mixed effects model is appropriate for representing and analyzing clustered data. In our analysis, individual observations are grouped by random factors, and therefore constitute the grouping level. In the analysis of variance, death fear was treated as the outcome variable, with fixed effects of current environment, LH and their two-way interaction. In the first instance, we fit a maximal random effects structure, which includes random slopes for each participant's repetitive measurement at different times. The evaluation of significance in mixed-effects models is to use the z distribution to obtain p-values from the Wald t-values (Luke, 2017). The statistical level of .05 was set as significant.

Results

Preliminary Analysis

The descriptive statistics of the demographic characteristics of the sample are summarized in Table 1. For a preliminary analysis, the response scores for the Mini-K Scheme, were categorized into two groups using the median-split: 0 = "fast LH group," 1 = "slow LH group." During lockdown, fear of death scores of the 98 participants who reported fast LH (M = 4.15, SD = .69) and the 104 participants who reported slow LH (M = 4.27, SD

= .79) did not differ significantly, $t(192) = -1.20$, $p = .23$ (Table 2). After lockdown, fear of death scores of the 105 participants who reported slow LH ($M = 4.95$, $SD = .92$) were significantly higher than those of the 97 participants who reported fast LH ($M = 4.20$, $SD = 1.34$), $t(184) = -4.63$, $p < .001$; Table 2). The preliminary multivariate multiple regression analysis showed no statistically significant effects of external variables on demographic variables except gender. More in detail, controlling for other external variables, no statistically significant effect of (1) age ($\beta < .01$, $SE = .01$, $p = .87$); (2) marital status ($\beta = -.03$, $SE = .11$, $p = .82$); (3) education level ($\beta = -.02$, $SE = .06$, $p = .72$). A small marginal effect was found on gender ($\beta = .17$, $SE = .10$, $p = .09$).

Effects of LH and Current Environment on Death Fear

Further model fitting was done using linear mixed effects regression model which incorporate both fixed and random effects (Zuur et al., 2009), allowing for the nature of the data (i.e., repetitive measurement in a time series). Fixed effects represent population-level (i.e., average) effects that should persist across different times (Brown, 2021). LH, current environment status and their interaction were included as fixed effect predictors. Random effects are clusters of dependent data points in which the component observations come from the same participant at different time points. Each participant's responses at time 1 and time 2 (using unique participant's ID) were included as a random effect, to allow for variance between each measurement. The results of the linear mixed effects model are displayed in Table 3. The intraclass correlation coefficient ($ICC = .07$) for each participant indicated that the repetitive measurement at different times accounted for 7% of the explained variance. The fixed effects showed that slow LH ($\hat{\beta} = 1.86$, $SE = .45$, $t = 4.15$, $p < .001$), current environment ($\hat{\beta} = .86$, $SE = .04$, $t = 20.34$, $p < .001$), and the two-way interaction between slow LH and current environment ($\hat{\beta} = -.47$, $SE = .09$, $t = -5.11$, $p < .001$) each had a significant effect on fear of death score difference. Each of the simple slope tests revealed a significant positive association between slow LH and death fear, but slow LH was more strongly related to death fear after lockdown (β = .86, *SE* = .04, t = 20.34, p < .001) than during lockdown (β = .38, *SE* = .08, t = 4.64, p < .001). Notably, there was a significant disordinal interaction between current environment and LH. As illustrated in Figure 1, current environment status moderated the association between slow LH and the fear of death, suggesting that slow LH strategy was predictive of more intense fear of death at lower levels of mortality threat in a given environment than at higher levels of this threat.

Discussion

The results of this study indicate that LH strategy, current environment and the two-way interaction between current environment and LH strategy was individually related to, and predictive of, the fear of death. Our findings demonstrate that two factors interact in opposing directions in influencing the fear of death. In particular, current environmental safety and unpredictability played a moderating role in the relationship between LH and death fear. In other words, slow LH strategy was associated with more intense death fear at lower than at higher levels of mortality threats in individuals' current environment. These conditional predictions suggest that when mortality threat was extremely high and when the future was highly unpredictable, LH manifestations could become less decisively calibrated. To reflect real-life psychological manifestations of LH that might not be encountered in a laboratory setting, we adopted a natural everyday setting of mortality salience instead of employing artificial mortality priming. In this study, people may slightly shift their LH strategy and/or become less dependent on their previous LH, in order to better adapt to the current unprecedented environment. These findings follow with past research that LH evolve in response to the environment (i.e., extrinsic factors; Nettle, 2013) and these environmental variations are assumed to affect life history traits through 'phenotypic plasticity' as individuals can respond to environmental cues to shift their LH strategy adaptively (Sear, 2020).

Investigating mortality threat psychology from an evolutionary perspective can lead to novel hypotheses and innovative approaches to support the integration of evidence across various analytical levels that is not integrated from existing theoretical perspectives. Death is the fundamental definition of conscious life; it is the experience and emotional responses that guide, influence, and even determine that which forms our lives and how we adapt to a changing environment (Yalom, 1980). The frightening aspect of death is tethered to a general sense of danger (Wilson, 1903), and the focus of fear is palpably related to survival threats (Marks, 1987). Theories on anxiety and fear of death and have provided a macrofocus on approaches to ‘managing’ death (e.g., pedagogically in death education and financially in research and public health; Fortner & Neimeyer, 1999) and on conceptual investigations of the meaning of death and the afterlife (Thorson & Powell, 1994). The LH perspective focuses on how LH strategy affects fear of death and outlines the evolutionary logic underlying these dynamics. Considering specific ecological factors (e.g., predators, nutrition, natural disasters, and disease) and resource constraints and scarcity, LH strategy evolution by natural selection depends on genetic variation on which selection can act to produce adaptations in response to the changing environment (Kaplan & Gangestad, 2005). When examining mortality threat from an evolutionary perspective, organisms that are better suited or adapted to their environment have higher likelihood of survival (Kaplan & Gangestad, 2005). Variations in individuals’ allocation decisions have generalized patterns on the fast–slow LH continuum. Applying the LH framework provides a means for studying evolutionary responses to mortality threats and unpredictable environments, particularly during unusual times such as pandemics. In this study, individuals who adopt slow LH strategies were generally more likely than those who adopt fast LH strategies to experience heightened fear of death in a less extreme environment (after lockdown with lower infection and death rates). This finding is consistent with reports that slow-LH individuals are more future oriented (Chen & Kruger, 2017) and thus their perceptions of an uncertain future may exert stronger impacts on their current psychological status.

Mortality awareness and unpredictability with unprecedented threat of death during an event like the COVID-19 pandemic lockdown has rarely been studied in the LH literature. The external environment operationalized herein was a larger ecology-wide variable affected by the pandemic in its influence on LH strategy and associated psychological responses (e.g., fear and anxiety). The research setting was realistic. The perception of environmental data from environmental sources and the processing of this mortality salience was essential in influencing psychological responses, which were also shaped by LH manifestations.

The overall impact of predictable variation on life history strategy is the evolution of additional life stages and potentially complex life cycles or events (Shefferson, 2010). Mounting evidence suggests that variation in the environment is associated with variation in life history traits and trade-offs (e.g., Walker et al., 2006), and such LH-related variation is linked to mortality risk and stressful environments (e.g., Frankenhuis et al., 2016; Nettle, 2015). Since many of the adaptations to the environment that allow organisms to deal with or escape these kinds of variability have created the diversity of LH (Shefferson, 2010). Despite some evidence of the predicted clustering of LH traits, the fixed 'fast-slow' continuum did not receive overwhelming support, not least because there was within sample variation (see Brown & Sear, 2020). Thus, it would be possible for LH strategy to be flexible under the influence of current extreme environment. In this study, both fast individuals and slow individuals reported similar scores of death fear during lockdown. Although uncontrollable environments generally favor the psychological manifestations of fast LH strategy (Mittal et al., 2015), during the 2020 lockdown, fast-LH individuals may still have experienced distress because the lack of social mobility for an extended time period may have strained their pursuit of immediate gains and because the threat of death was sufficiently considerable to override their hedonistic inclinations. The environmental cues reflect high mortality rates would neither prioritize fast LH (immediate gains) nor slow LH (future goals) because these immediate threats may outcompete the pre-existing LH manifestations. Future study could further investigate the possible fluctuation of LH strategy in different ecological-wide paradigms with a longitudinal design.

Stress and panic swept through Hubei's communities in waves during government-mandated lockdown and self-isolation. Individuals may develop adaptive methods to cope with their fear of death, such as establishing meaningful relationships and social connections (Yalom, 2008) and seeking emotional support from others. Studies have demonstrated that social connection, a sense of belonging and closeness with others, is fundamental to human development and well-being (e.g., Baumeister & Leary, 1995; Sun et al., 2019). This social connection was especially vital during the 2020 lockdown, when public gatherings were prohibited (later strictly regulated). Individuals who adopt slower LH strategy may previously have had more stable relationships, whether familial, romantic, or social (Del Giudice & Belsky, 2010). Slow-LH individuals may therefore have formulated more adaptive strategy and acquired more familial and social support (Gladden et al., 2009). During the compulsory lockdown, slow-LH individuals may have benefitted from the stable relationships they had created. Thus, during lockdown and self-quarantine, variations in the perceived environmental cues of mortality rates have driven and continue to drive individual distinctions in the predominance of cooperative (slow LH) versus unstable or distant (fast LH) social relationships (Figueredo et al., 2018). Our findings showed a significant reduction in death fear scores during lockdown for slow individuals. These findings suggested that social connections could contribute positively to individuals' overall sense of connectedness, encouraging some of them to shift their LH to a slower direction and/or rely more on their previous familial and social support, thereby alleviating feelings of a loss of control and a fear of the unknown future. These individual variations in LH manifestations appear to have strong effects on coping with fear during considerably worrisome and uncertain times. Future studies may expand on these findings to explore effects in LH variation that influence the intensity of fear of death in various circumstances.

Our findings should be interpreted cautiously because of the following limitations. First, given the relatively small number of participants, it was not feasible to examine whether there were more detailed differences based on repetitive measurement at different time points. Furthermore, time series data are frequently nonstationary and further longitudinal studies with more time points are warranted to provide a more comprehensive understanding of the cumulative and long-term effects of individuals' fear of death on LH strategy as an adaptive response to a current environment. Additionally, larger sample sizes are required to better examine LH variations and delineate their interactions with current environmental factors such as cross-provincial or cross-national residential location. For example, large-scale samples conducted across various regions may uncover distinctions in perceived threats of death between individuals living in Hubei (where the infection rate was particularly high in the first quarter of 2020) and outside of Hubei. Second, the self-reported nature of the survey could have led to bias regarding variations in LH strategy and the fear of death. Consequently, a more in-depth investigation of participants' psychological reactions regarding fear or anxiety when their current environment is highly unpredictable and challenging, perhaps with experience sampling, qualitative methods, or daily diary application, is warranted. Third, the experience of confinement due to the COVID-19 pandemic has reinforced existing inequalities among some groups (e.g., older people, the homeless, people with low SES) who may not be able to access electronic devices and digital technologies. The data collection has relied on web-based survey; therefore, these marginalized groups may be excluded from this study. Finally, we used the multidimensional orientation toward dying and death as a dependent measure to examine cumulative attitudes toward mortality. Future studies may consider determining the effects of various expositions of death fear and examining more explicit mortality attitudes. This study is the first to compare associations between LH strategy and fear of death and the current environment's moderating role in this regard. Future studies should consider conducting more systematic investigations into the specific emotional responses and behaviors involved in this process as it relates to individuals' LH strategy and environments.

Our study is among the first to consider a natural environment and its interaction with individuals' LH strategy on the subject of fear of death under threats to survival. The application of the evolutionary framework of LH theory has immense potential to explain why and how an individual's emotional process respond to a specific environment. Such LH strategy expression may involve long-term versus short-term preference (Del Giudice & Belsky, 2010), risk avoidance versus boldness (Copping et al., 2013), stable versus unstable social connections (Figueredo et al., 2018), and numerous psychological and behavioral aspects of LH trade-offs. LH theory emphasizes environmental contexts and individual distinctions, focusing on the micro aspects of psychological responses in changing environmental conditions. Our results reveal that an individual's current environment contributed critically to LH strategy and its psychological manifestation. When individuals encounter certain large-scale environmental challenges (e.g., pandemics, natural disasters, or famine), individual-level LH–related variables such as personality, family function, and social ties may become integral parts of the surrounding environment's perceptive and adaptive reactions. Under social distancing interventions that commenced in spring 2020, millions of individuals around the world could no longer go to work or school in person or even leave their homes. These extraordinary environmental conditions led individuals to attach great importance to often-absent social closeness, belonging, and connection (Okabe-Miyamoto et al., 2021), with the shifting of slower-end of LH. Our data can serve as a reference for practitioners across various disciplines to offer services to individuals who must enter social isolation during unusual events such as the pandemic. Policymakers should consider developing guidelines for physical distancing that mitigate fear and anxiety and retain a sense of closeness and connection. For example, local governments could provide online counselling. Systematic studies of individuals' distinctions in psychological responses when facing mortality threats are necessary. These investigations should involve explorations of underlying factors, such as family structure and socio-economic status. To the best of our knowledge, this study is one of the first to examine how individuals' current environments and LH interact in calibrating individuals' adaptive psychological manifestations of fear of death during the COVID-19 pandemic.

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Table 1

Demographic Characteristics of the Participants (n = 202)

Characteristics	*Mean (SD) or n (%)*
Age in years, mean (SD)	30.58 (7.53)
Gender *female*, n (%)	89 (44.06%)
Marital status *married*, n (%)	136 (67.33%)
Education level (college degree or above), n (%)	151 (74.75%)
Occupational status, n (%)	
– employed/self-employed	156 (77.23%)
– unemployed	18 (8.91%)
– retired	28 (13.87%)
Household monthly income, n (%)	
– below 2,000 RMB or 2,000 to 4,000 RMB	33 (16.33%)
– 4,000 to 8,000 RMB	106 (52.48%)
– 8,000 to 12,000 RMB or above 12,000 RMB	63 (31.19%)
Current location, n (%)	44 (20.8%)
– Wuhan	94 (46.53%)
– Other locations in Hubei	108 (53.47%)

Table 2

Comparison of Fear of Death by Life History Strategy and Time

	Time Period							
	During Lockdown				After Lockdown			
LH Strategy	n	*M*	*SD*	*t*	n	*M*	*SD*	*t*
Fast Group	98	4.15	.69	-1.20	97	4.20	1.34	-4.63***
Slow Group	104	4.27	.79		105	4.95	.92	

Note: *P*-value by the *t* test.

$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Table 3

Linear Mixed Effects Model

Predictors	Estimates [a]	*SE*	*95% CI*	*t*	*df*	*p*
(Intercept)	.48	.21	[.07 – .88]	2.30	201	.022
Current Environment	.86	.04	[.77 – .94]	20.34	199	<.001
LH	1.86	.45	[.98 – 2.75]	4.15	199	<.001
Environment * LH	-.47	.09	[-.66 – -.29]	-5.11	199	<.001
Random Effects						
σ^2 = .41						
ICC = .07						
N_{ID} = 202 [b]						

Note: [a] coefficient estimate beta (= $\beta/SE(\beta)$), associated with the Wald's z-score.

[b] Observations = 404

Marginal R^2 =.54.

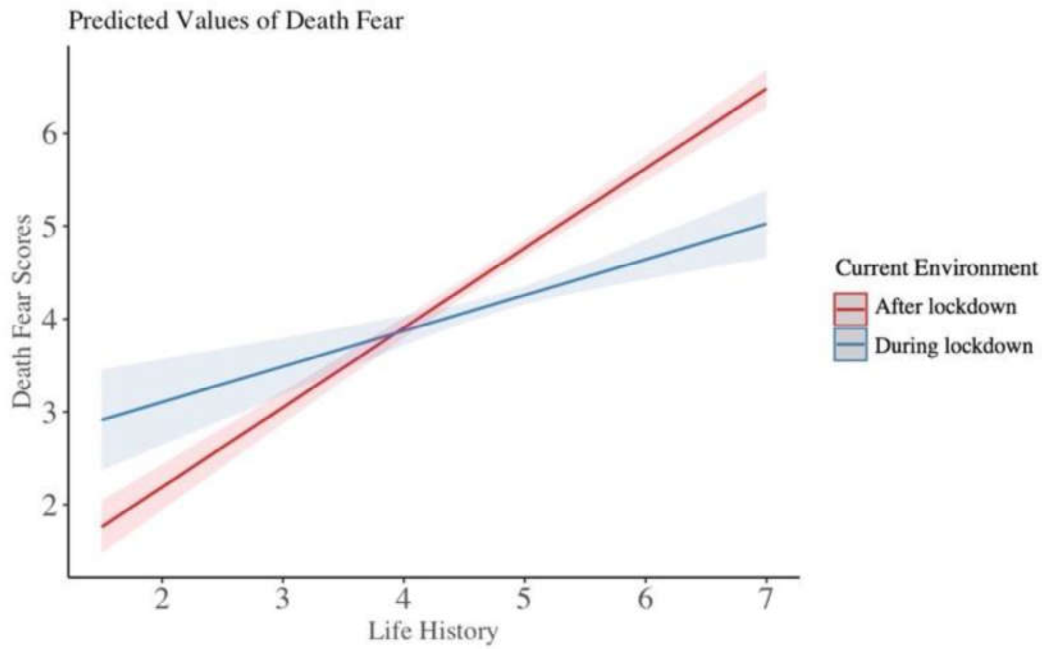

Figure 1. Simple slopes and 95% confidence bands from death fear regression on LH during lockdown (flatter; blue) and after lockdown (steeper; red) in linear mixed effects model (Higher LH values indicate the presence of a greater inclination of slow LH).