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Slow Life History Strategies and Increases in Externalizing and Internalizing Problems during the COVID-19 Pandemic

Lei Chang, University of Macau, chang@umac.mo

Yuan Yuan Liu, University of Macau, yb87307@connect.um.edu.mo

Hui Jing Lu, The Hong Kong Polytechnic University, huijing.lu@polyu.edu.hk

Jennifer E. Lansford, Duke University, lansford@duke.edu

Marc H. Bornstein, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, UNICEF, and Institute for Fiscal Studies, UK, marc.h.bornstein@gmail.com

Laurence Steinberg, Temple University, and King Abdulaziz University, Jeddah, Saudi Arabia, lds@temple.edu

Kirby Deater-Deckard, University of Massachusetts, kdeaterdeck@umass.edu

W. Andrew Rothenberg, Duke University and University of Miami Miller School of Medicine, war15@duke.edu

Ann T. Skinner, Duke University, askinner@duke.edu

Kenneth A. Dodge, Duke University, dodge@duke.edu

Abstract

The COVID-19 pandemic is but one of many instances of environmental adversities that have recurred in human history. Biobehavioral resource allocation strategies, known as fast (reproduction-focused) vs. slow (development-focused) life history (LH) tradeoff strategies, evolved to deal with environmental challenges such as infectious diseases. Based on 141 young people and their mothers observed prior to (ages 9 and 13) and during (age 20) COVID-19, we investigated longitudinal relations involving slow LH strategies. The results support the adaptive role of slow LH strategies in reducing COVID-related increases in externalizing problems. In addition, the effect of early adversity on COVID-related increases in externalizing was mediated, and the effect on COVID-related increases in internalizing was moderated, by slow LH strategies.

Keywords: Adolescent externalizing and internalizing; childhood environmental adversity; Fast and slow life history strategy

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The ongoing coronavirus disease 2019 (COVID-19), a newly emerged respiratory disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has had a psychological impact on people of all ages, including adolescents (Bornstein, 2021). Although the devastation wrought by COVID-19 appears unprecedented, disease pandemics

have recurred throughout human history. Any measure for mitigating the psychological impact of the current pandemic should reflect the evolutionary understanding that humans, as well as other animals, have evolved coping strategies shaped by evolutionarily recurrent adversities, including infectious diseases. These environmental adversities and risks occurring especially in childhood engender coordinated tuning of physiological (e.g., endocrine and homeostasis) and psychological systems (e.g., cognition and behavior) in making energy tradeoff allocations (Del Giudice et al., 2015). Collectively, such regulatory biobehavioral responses are known as fast and slow life history (LH) tradeoff strategies. They regulate human development and behavior (Chang & Lu, 2017; Del Giudice et al., 2015; Ellis et al., 2009; Stearns, 1992), including responses to the COVID-19 pandemic (Lu et al., 2021). The present study aimed to use the evolutionary LH framework to examine the psychological impact of the COVID-19 global pandemic on a sample of young people. We investigated contingent associations between childhood environmental adversities and LH strategies observed in different years prior to the onset of COVID-19 and increases in externalizing and internalizing difficulties occurring during the COVID-19 pandemic.

Evolution of Fast and Slow LH Strategies

Throughout evolution, pathogens and infectious diseases like the coronavirus and other extrinsic mortality risks (e.g., predation, famine, and war) prevent organisms from acquiring sufficient resources (e.g., food and safety) to support their life needs. Tradeoffs therefore occur between different intrinsic life needs and can be summarized into two types: (1) growth and development, including learning and parenting or helping the next generation to learn and develop, and body repair and maintenance and (2) reproduction. The biobehavioral results (life history traits) and the tradeoffs form LH tradeoff strategies. Those that invest more energy and time in growth and development to result in slower and more invested growth and development are called slow LH strategies, whereas those that invest more in reproduction by having faster and less invested growth and development are called fast LH strategies (Ellis et al., 2009; Stearns, 1992). Parallel to the fast vs. slow pace of life is a cognitive and behavioral representation of time, with fast LH associated with shorter-time spans and a present orientation and slow LH associated with longer-term plans and a future orientation (Sear, 2020). Other behavioral traits include an affiliative and altruistic sociality that is mindful of future cooperation and long-term reciprocation, in contrast to an antagonistic and utilitarian social interactional style, aimed at serving immediate and self-focused survival needs (Chang et al., 2019; Figueredo et al., 2018).

Extrinsic risks inflict mortality and morbidity on the adult population independent of individuals' intrinsic life conditions (e.g., good health) or survival efforts (e.g., good health habits). When such risks are high (as in environmental harshness) or highly variable (as in environmental unpredictability), fast LH strategies prevail because they increase the chances that individuals will escape mortality and morbidity postreproductively through fast growth and early reproduction. The associated cognitive short-horizons and present orientation are equally adaptive in dangerous and precarious environments difficult to predict the future. In safe and predictable environments of low mortality risks and high future foreseeableness, slow LH strategists outcompete fast strategists by investing in growth and development and learning and parenting. In short, evolution tends to couple safe and stable living environments, especially in childhood, with slow LH strategies and harsh and unpredictable childhood environments with fast LH strategies.

Current Living Conditions, COVID-19, and LH Manifestation

Evolutionarily selected fast-slow LH traits and strategies are plastic (Del Giudice & Belsky, 2011; Sear, 2020). Within certain bounds, they adaptively respond to cues from the present living environments and regulate behavior accordingly. Grouped together as environmental adversities, harshness and unpredictability are indicated by such proxies as change of employment or residence (e.g., Simpson et al., 2012; Zuo et al., 2018), dangerous neighborhoods (e.g., Hampson et al., 2016), chaos in the home (e.g., Del Giudice et al., 2012), negative life events (e.g., Simpson et al., 2012), and low family income or socioeconomic status, income change, and income to needs ratio (e.g., Belsky et al., 2012; Doom et al., 2016; Szepeswol et al., 2021). Consistent with LH predictions, these proxies of environmental adversities are correlated with fast LH strategies (e.g., Brumbach et al., 2009; Chen et al., 2017; Stamos et al., 2021) and fast LH traits such as aggression (e.g., Doom et al., 2016; Ellis et al., 2021; Simpson et al., 2012). When examined in relation to specific behavioral outcomes (e.g., unrestricted sociosexuality or antagonistic sociality; Patch & Figueredo, 2017), early environmental adversities and fast or slow LH strategies are predictive of the outcome behavior in predicted directions. These findings implicate the statistical mediating effect of LH strategies on relations between earlier environmental conditions and subsequent behavioral outcomes (e.g., Corral-Verdugo et al., 2020; Figueredo et al., 2020; Luo et al., 2020; Stamos et al., 2019).

Within the LH framework, childhood environmental adversities are expected to be negatively associated with slow LH strategies (environment shaping LH) that are negatively associated with COVID-related increases in externalizing difficulties (LH regulating behavior). Childhood environmental adversities are also expected to influence COVID-related behaviors via the statistical mediation of slow LH strategies that are shaped by early environments. Compared to present-focused fast LH strategists, future-oriented slow strategists are expected to be more cooperative and compliant with, and less antagonistic and resistant to, various disease control and public health measures. Such measures inconvenience and disrupt present life activities including, especially for the young adult population, mating. The bipolar behavioral traits comprising the fast-slow LH strategic continuum (e.g., affiliative, altruistic, and cooperative vs. antagonistic, exclusive, and utilitarian sociality, and insight, planning, and control vs. impulsivity, emotionality, and immediate reward) also make life during the pandemic overall easier for slow strategists or more difficult for fast strategists. Fast strategists are therefore expected to demonstrate more pandemic-increased difficulties especially of the externalizing type compared to slow strategists. Additionally, the experience of COVID-related externalizing difficulties is related to adverse childhood environments and behavioral organization and regulation of LH strategies shaped by the same childhood experience (Del Giudice & Belsky, 2011).

The relation between slow LH strategies and internalizing difficulties is more complex with mixed evidence implicating ambiguity at both ends of the fast-slow LH continuum (Del Giudice, 2014). The cognitive aspect of slow LH strategies relates to self-regulation, effortful control, delaying gratification, insight, planning, and being prosocial (Chen & Chang, 2016; Figueredo et al., 2006), all of which suggest strong executive functioning and other cognitive qualities that are potentially useful for buffering against emotional and internalizing difficulties. However, there is also evidence that overcontrol is associated with higher risk for internalizing problems such as anxiety and depression (e.g., Eisenberg et al., 2001; Huey & Weisz, 1997). Another hallmark trait of slow LH is conscientiousness (Del Giudice, 2018), which has been found to be positively (Compas et al., 2004) and negatively (Kotov et al., 2010) correlated with internalizing problems such as

depression. Similarly ambiguous, fast LH is characterized by impulsivity, emotionality, reactivity, and reduced executive function (Morgan & Lilienfeld, 2000), all of which may lead to further emotional and internalizing problems. However, because fast LH is robustly associated with externalizing mainly for its aggressive sociality (Del Giudice, 2014), an equally strong association between fast LH strategies and internalizing is unlikely. Some studies have also suggested that fast strategists are less effective in coping with stress compared to slow strategists (van der Linden et al., 2018) who excel in control, insight, and planning (Figueredo et al., 2018). COVID-19 preventive measures and life during the pandemic in general may therefore be more stressful for adolescents on the faster than slower end of the LH continuum. Within the stress sensitivity framework (Ellis et al., 2017), stress from the COVID-19 pandemic combined with stress from childhood living environments may increase internalizing especially for fast compared to slow LH strategists. Considering different evidence, we expect childhood environmental adversities to be more predictive of COVID-related internalizing increases at the lower or faster end of the slow LH strategies.

Present Study

Within the aforementioned theoretical framework, we tested a set of hypotheses concerning the role of slow LH strategies in a community sample of 141 youth and their mothers. We hypothesized that childhood environmental adversity—comprising unsafe neighborhood, unpredictable life events, chaos at home, and family income change obtained from mothers and youth when the latter were 9 years old on average— would be negatively associated with slow LH strategies, measured by 46 items with higher scores indicating slower LH, when the youth were 13 years old on average. These two variables were hypothesized to be positively (for childhood environmental adversities) and negatively (for slow LH strategies) associated with COVID-related increases in externalizing and internalizing problems during the pandemic when youth were approximately 20 years of age. We also expected a statistical mediating effect of slow LH strategies on the relation between childhood adversities and COVID increased externalizing difficulties. Finally, we hypothesized a moderating effect of slow LH strategies on the relation between environmental adversities and increased internalizing. Specifically, we expected a stronger positive association between environmental adversities and COVID-related increase in internalizing for lower levels of slow LH strategies.

Method

Participants

A subsample of youth and their parents from the Parenting Across Cultures (PAC) study was recruited for the current project. PAC is a prospective, longitudinal study of parenting practices and child development (see <http://parentingacrosscultures.org> for more details). At the beginning of this project, recruitment letters written in both English and Spanish were sent to 15 public and 2 private elementary schools in Durham, North Carolina. Letters explaining the study were left at the 17 schools, and the schools sent the letters home with students. If families were willing to participate, they returned the letter to the school, and the PAC team then contacted parents directly to interview them at a place of their choosing, such as their home or a library, yielding a 24% response rate. The original PAC cohort consisted of socioeconomically and ethnically diverse families of which 110 were European American, 102 were African American, and 99 were Latino (49% girls; $M_{\text{age}} = 9.09$, $SD = .60$). Participants have been interviewed annually since then. The present study uses data from three time points, when participants were ages 9, 13, and 20, on average.

COVID data included in the present study were collected when youth were approximately age 20. COVID data were collected using a truncated data collection period mostly in April, 2020 to quickly complete the analyses and help mental health professionals respond more effectively to the devastation caused by the pandemic. As a result, only 141 participants (54% female) of the initial sample provided data; this figure does not represent attrition from the ongoing longitudinal study but merely the participation rate during the compressed timeframe for COVID data collection. Compared to the initial sample, participants who provided COVID data and those who did not did not differ on any non-COVID variables used in the present study.

Procedure

Measures used in the present study were obtained from interviews with the participating families. The interviews and other procedures were approved by the XX University Institutional Review Board (IRB, protocol number 2032). Mothers provided written informed consent, and children provided assent at the age 9 and 13 assessments; youth provided their own consent at the age 20 assessment. Family members were interviewed separately to ensure privacy. At the age 9 and 13 assessments, participants were given the choice of completing the measures in writing or orally, with the interviewer reading the questions aloud and recording the participants' responses (with a visual aid to help the participants understand the response scales). At the age 20 assessment, participants primarily completed measures online through a Qualtrics link sent to their phone or email. To thank participants for their participation, youth who were children during the first two waves of data collection were given small gifts or monetary compensation. Parents were given modest financial compensation, and families were entered into drawings for prizes.

Measures

Childhood Environmental Adversity. The following four measures were obtained when the children were approximately 9 years old. The four form the latent construct of childhood environmental adversity.

Unsafe Neighborhood. Mothers and children separately responded to a 7-item subscale that measures perceived safety and livability of a neighborhood (Murray & Greenberg, 2006). The full measure has since been validated multiple times (e.g., Ridenour et al., 2006). Sample items include, "My neighborhood is a dangerous place to live," and "I feel scared in my neighborhood." Using a 4-point scale ranging from 0 = "almost never true" to 3 = "almost always true," the items were measured such that higher scores indicated a less safe neighborhood. Internal consistency reliability estimates (*a*) were .87 for mother reporting and .84 for child reporting. The correlation between the two ratings was .37 ($p < .01$). For the structural equation modeling and other analyses reported below, the average of the two ratings was used as an indicator of childhood environmental adversity.

Unpredictable Life Events. Using the Social Readjustment Rating Scale (Holmes & Rahe, 1967), which has been recently validated (Scully et al., 2000), mothers reported on whether ten unpredictable life events happened in the last 2 years in the family and to which the child was likely exposed. Sample items include "severe and/or frequent illness," "accidents and/or injuries," and "death of other important person." The ten items were averaged to form another indicator of childhood environmental adversity. This composite indicates more risks than individual items but there is no expectation that the experience of any given risk necessarily shares an underlying cause with other risks (Streiner, 2003).

Consequently, internal consistency among the items is not expected, and they are treated as an index rather than a scale (Streiner, 2003).

Chaos at Home. Using a 5-point scale ranging from 1 = “definitely untrue” to 5 = “definitely true,” mothers and children responded to five items from the Confusion, Hubbub, and Order Scale (Matheny Jr et al., 1995) that measures chaos at home. The measure has been recently validated (Deater-Deckard et al., 2019). Sample items include “It’s a real zoo in our home,” and “You can’t hear yourself think in our home.” Internal consistency reliability estimates were .64 for mothers and .62 for children. The correlation between the two ratings was .36 ($p < .01$). In the subsequent analyses, the average of the two ratings formed an indicator of environmental adversity.

Family Income Change. Mothers provided two ratings during a 2-year period on how much in the last 12 months the household’s annual income changed and indicated the change on a 5-point scale (1 = decreased a lot (more than 25%); 2 = decreased a little bit (between 5 and 25%); 3 = did not change at all or it did not significantly change (less than 5%); 4 = increased a little bit (between 5 and 25%); 5 = increased a lot (more than 25%)). The two ratings over two years were averaged to form the final variable. The correlation between the two ratings was .18 ($p < .05$). The item was used to capture financial instability over the 2-year period, and internal consistency or high correlation was not expected.

Slow LH Strategies. The 199-item Arizona Life History Battery (ALHB; Figueredo et al., 2007) samples cognitive and behavioral indicators from seven domains of resource allocations—Insight, planning, and control; Mother/father relationship quality; Family social contact and support; Friends’ social contact and support; General altruism; Romantic partner attachment; Religiosity. There are two short versions of the ALHB that are more widely used, the Mini-K (Figueredo et al., 2006) and the K-SF-42 (Figueredo et al., 2017). The latter has 42 items selected from the ALHB items with six measuring each of the seven ALHB subscales. It measures a single factor in the direction of slow LH (Figueredo et al., 2017).

We adapted and modified 46 ALHB items to measure five subscales (Romantic partner attachment and Religiosity were not used because of the younger child age and multicultural design of the original study). We obtained the measures when the children were 13 years old on average. They responded to these questions either on a 6-point or 4-point scale consistent with the ALHB. Ten items were used to measure Insight, planning, and control ($\alpha = .86$; e.g., “Once I make a plan to get something done, I stick to it,” and “I can do just about anything I set my mind to”). Sixteen items with 8 for each parent were used to assess Parent-child relationship quality ($\alpha = .90$; e.g., “Dad/mom pays attention to me,” and “Dad/mom makes it easy for me to confide in him/her”). Family social contact and support was measured by eight items ($\alpha = .74$; e.g., “Spend time with grandparents, cousins, aunts and uncles,” and “Do well for the sake of the family”). Six items were used to measure Friends’ social contact and support ($\alpha = .85$; e.g., “I have friends that I really care about,” and “When something good happens to me, I have people in my life that I like to share good news with”). General altruism was assessed by 6 items (e.g., “I try to help others,” and “I share things I like with friends”). Internal consistency reliability estimate (α) was .70. These five subscales form a composite measure with higher numbers indicating slow LH strategy.

Increase in Externalizing and Internalizing due to COVID-19. When they were age 20, on average, participants were asked to note and report changes in four areas of their life

(i.e., anger, argumentativeness, anxiety, and depression) by comparing after to before the outbreak of COVID-19. This measure of COVID-19 mental health was first developed by Skinner et al. (2021) and has since been used and validated in several independent investigations by different research teams (e.g., Kapetanovic et al., 2021). Sample items included “I get in more arguments now than I did before the outbreak” and “I feel more anxious now than I did before the outbreak.” The items were rated on a 4-point scale with 1 = strongly disagree, 2 = somewhat disagree, 3 = somewhat agree, 4 = strongly agree. The mean of the anger and argumentativeness items ($r = .56, p < .001$) formed the externalizing increase variable, and internalizing increase was created by taking the mean of the anxiety and depression items ($r = .51, p < .001$).

Data Analysis

We used G*Power 3.1 to estimate sample size for multivariate analysis involving 14 variables (13 indicators plus an interaction term) (Faul et al., 2007). Sample size was deemed sufficient for detecting associations representing medium effect size based on $\alpha \leq .05$ and statistical power $\geq .80$. Sample size was further supported by the rules of having sufficient cases per observed variable (Nunnally, 1967) or per estimated parameter (Bentler & Chou, 1987).

We conducted structural equation modeling (SEM) tests using *Mplus* 7.0 (Muthen & Muthen, 2012) and using full information maximum likelihood estimation procedures to handle missing data (Schafer & Graham, 2002). We used the following goodness of fit statistics and the recommended cut-off values to assess model fit: chi-square to degrees of freedom ratio ($\chi^2/df < 5.0$; Kline, 1998), Comparative Fit Index ($CFI \geq .90$; Marsh et al., 1998), Tucker-Lewis Index ($TLI \geq .90$; Marsh et al., 1998), Root Mean Squared Error of Approximation ($RMSEA \leq 0.08$; Browne & Cudeck, 1993), Standardized Root Mean Square Residual ($SRMR \leq 0.08$; Hu & Bentler, 1999).

Results

Table 1 presents the means, standard deviations, and correlations of all the variables used in the study. The correlations were based on different informants (i.e., child and mother) and over relatively long time lags of up to 7 years. They showed good convergent and discriminant validity with mono-trait measures more highly correlated with each other than with hetero-trait measures. Inter-trait correlations were also in the expected directions, with indicators of environmental adversity (i.e., unsafe neighborhood, unpredictable life events, chaos at home, and family income change, which were obtained mainly from mothers) negatively and mostly significantly correlated with indicators of slow LH strategy (i.e., insight, planning and control, parent-child relationship, family support, social support, and general altruism that were measured three years later from child report). These indicators were also longitudinally correlated with increases in externalizing and internalizing problems during the COVID-19 pandemic 7 to 11 years after the pre-COVID data were collected. These correlations support our LH theorizing. We also present the means and *SDs* of the variables for the two genders and for the three ethnic groups separately in Table 2. Overall, there are a few mean differences across gender and ethnicity as reported in Table 2, but there are few statistically significant differences in the zero-order correlations or structural relations between the two genders and among the three ethnic groups.

For model testing, we first tested the model in Figure 1 without the interaction term. The goodness of fit statistics ($\chi^2/df = 2.47$, $CFI = 0.93$, $TLI = 0.90$, $RMSEA = 0.073$, $SRMS$

= 0.088) of the model met the recommended cut-off values for adequate model fit. We then included the interaction construct in the model, which is related to the hypothesized moderating effect of slow LH strategies in relation to COVID internalizing increases. In computing the interaction construct (by multiplying the indicators of the two concerned constructs, environmental adversity and slow LH strategy), we used the *Mplus* default approach rather than manually pairing indicators and multiplying them (Marsh et al., 2004). The *Mplus* approach does not provide goodness-of-fit statistics (Maslowsky et al., 2015; Muthén, 2012). Instead, *Mplus* provides a measure, D , of relative fitness of the interaction model compared to the main-effect-only or baseline model without the interaction term. D is the difference of the log-likelihood values of the two models ($D = -2 \times [(\text{log-likelihood for the main effect model}) - (\text{log-likelihood for the interaction model})]$; Muthén, 2012). D follows chi-square distribution with DF being the difference in the number of estimated parameters between the two models, which, in the present case, was 1. The log-likelihood for the main-effect-only or baseline model was -3512.77 and that for the interaction model was -1967.38, $D = 3090.78$, $p < .001$, indicating that the interaction model showed substantial and statistically significant improvement in data fit over the baseline model. The interaction term was defined only in relation to internalizing. When we included externalizing, the interaction effect on externalizing was nonsignificant ($\beta = .04$, $p = .62$), and the log-likelihood (-1967.89) almost did not change (compared to the previous value of -1967.68), suggesting the interaction involving internalizing contributed mostly or solely to fitness improvement over the baseline main-effect-only model. Estimates for the final model with the interaction effect on internalizing are reported in Figure 1.

As shown in Figure 1, all the parameter estimates were in the expected directions, and most were statistically significant. For factor loadings, all but two were .50 or higher, and the average loading was .66, suggesting that the measurement model was adequate. Parameter estimates of the structural model were consistent with our LH theorizing. Environmental adversity negatively predicted slow LH strategies ($\beta = -.44$, $p = .001$), which negatively predicted increases in externalizing problems during COVID-19 ($\beta = -.45$, $p = .001$). The direct effect of environmental adversity on externalizing ($\beta = .05$) was nonsignificant. The mediating effect of slow LH strategies between environmental adversity and externalizing was significant ($\beta = .19$, $p = .02$, 95% Confidence Interval = [0.07, 0.34]) based on a bootstrapping procedure with 2000 resamples and the maximum likelihood estimation. If we did not include the mediating link of slow LH, the direct effect from environmental adversity on externalizing was significant ($\beta = .27$, $p = .04$). The findings demonstrate the robustness of slow LH strategies in predicting COVID-increased externalizing difficulties both directly and indirectly by mediating the effect of environmental adversity.

With respect to internalizing, the main effect of environmental adversity was nonsignificant ($\beta = .15$, $p = .48$), and the main effect of slow LH strategy was nonsignificant ($\beta = -.32$, $p = .08$). The interaction effect was significant ($\beta = -.32$, $p = .04$), with slow LH strategy moderating the association between environmental adversity and increase in internalizing. Figure 2 displays the simple slopes of environmental adversity on internalizing at 1 SD and -1 SD of slow LH strategy ($\beta = .03$, $p = 0.78$; $\beta = -.37$, $p = .002$). That is, at the lower end of slow LH strategies (i.e., fast or faster LH), environmental adversity prior to COVID-19 had a negative impact on internalizing increases during COVID-19, whereas the negative and longitudinal effect was muted at the higher end of slow LH strategies (i.e., slow or slower LH).

Discussion

Slow LH strategies, measured long before the coronavirus pandemic, negatively predicted a COVID-19 related increase in externalizing. Slow or slower LH strategies also mediated the impact of childhood adverse environment on COVID-19-worsened externalizing. These findings suggest that the slower end of the LH strategic continuum, relative to the faster end, provides a better buffer against negative environmental impacts, from either the past or the present. Shaped by how safe, as well as how abundant in resources, the living environment is, the LH strategy is a physiologically and psychologically coordinated strategy for allocating energy to cope with environmental adversities (Chang & Lu, 2018). Slow LH strategies handle such environmental risks (e.g., a potential COVID-19 infection) by allocating energy for body repair and maintenance (e.g., recuperating in a hospital) and behavioral control in response to infections (e.g., social distancing), while also allocating energy away from other aspects of life, such as reproduction (e.g., going on a date). The cognitive and behavioral aspects of slow LH strategies that involve planning, insight, and control (Figueredo et al., 2018) are especially suited to handling infectious diseases, which are an evolutionarily recurrent mortality threat. Fast or faster LH strategies involve taking risks rather than allocating energy to attempt to seize control of a precarious situation. Rather than attempting to overcome and outlast mortality risks, fast LH strategies work by realizing fast development and early reproduction to post-reproductively outgrow environmental risks and adversities. These predispositions or pre-existing strategies influence the ways young people likely coped with the COVID-19 pandemic and its preventive control measures. Youth on the slower end of the fast-slow LH continuum will be relatively more ready and determined to fight the pandemic, more willing to assume responsibilities, and more vigilant about taking precautionary measures such as mask wearing, hand washing, and social distancing (and vice versa for youths toward the faster end of LH strategies). Subsequently, youth at the slower end should have fewer adjustment problems than those at the faster end, who are also more likely to behave antagonistically when faced with adversities (Figueredo et al., 2018).

However, slow LH strategies did not have a main effect on internalizing, as indicated by the nonsignificant association between slow LH and increases in internalizing due to COVID-19. This finding is consistent with the literature, wherein either slow or fast LH has not been directly implicated in the development of internalizing difficulties (Del Giudice, 2018). However, slow LH strategies had a significant moderating effect on the relation between childhood adversities and the increase in internalizing during the COVID-19 pandemic. At the higher end of the fast-slow LH continuum, this relation was muted or nonsignificant, whereas this association was positive and significant at the lower end. This finding helps to resolve potential inconsistencies in the literature. The literature on stress sensitivity (Ellis & Del Giudice, 2019) shows that childhood stress has lasting, “negative” effects that direct individuals toward fast LH during adulthood (e.g., Ellis et al., 2017). However, studies have also reported positive effects. For example, low socioeconomic status during childhood, which is a pervasive measure of stress and adversity, is correlated with risk aversion (Haushofer & Fehr, 2014), empathy (Stellar et al., 2012), prosociality (Amir et al., 2018), altruism (Piff et al., 2010), and ethical behavior (Piff et al., 2012), all of which are characteristics of slow LH. The present findings suggest that childhood environment shapes LH strategies, which in turn redirect children into two separate developmental pathways: one in which the negative impacts of childhood stress intensify and continue into the adulthood of fast LH followers and the other that is followed by slow LH strategists who may resist and

even reverse the detriments of childhood adversity. For youth at the faster end of the LH continuum who are predisposed to taking a chance with environmental hazards, combining past and present adversity may render sufficient sensitization to worsen internalizing difficulties during COVID-19. However, the same stress sensitization may not affect youth who follow slow LH because, predisposed to control mortality risks (Figueredo et al., 2018), they are relatively more determined to comply with and actively practice COVID-19 control measures.

Overall, the findings indicate that externalizing is a highly persistent difference between fast and slow LH behavioral manifestations (Del Giudice, 2018). Slow LH strategies are characterized by prosociality comprising affiliative, altruistic, and cooperative social interaction styles. Fast LH strategies are characterized by antisociality engendering aggressive, antagonistic, and exclusive social relationships. Intensified and brought to the limelight by the coronavirus crisis, this fast—slow contrast has manifested throughout the pandemic at the local and national levels. Unprecedented public health measures and efforts have been implemented at micro (individual-level) and macro (government-level) scales. Together with these behavioral control efforts were heightened conscientiousness, compliance and cooperation, and compassion for fellow citizens and respect for authority — all of which are manifestations of slow LH. However, this slow LH sociality has occurred alongside a rise in the disregard of disease control measures, public orders, and social propriety (Ward, 2020), as well as violence, attacks (e.g., storming of the U.S. Capitol), and hate crimes (e.g., killing of George Floyd and over 3800 hate incidents against Asian Americans; Donaghue, 2020). These antagonistic incidents and behaviors represent pandemic-intensified, fast LH manifestations. As indicated by the findings of the present study, the more adaptive slow LH strategies have so far prevailed and likely will prevail in the end, as it has throughout human evolutionary history (Mace, 2000). These other events in the last year, in addition to the COVID pandemic, may also have contributed to changes in internalizing and externalizing problems.

The present study has a few limitations. First, the K-SF-42 used in the present study is intended to measure “a set of cognitive and behavioral indicators of LH strategy” (Figueredo et al., 2017, p.4) that is narrower in meaning than the original construct used in biological research that focuses on biological, physiological, and behavioral dimensions of LH. However, our COVID-19-related aim and disease control involve primarily cognitive and behavioral systems (Lu et al., 2021). Second, participants were asked to report the extent to which their externalizing and internalizing increased during the pandemic, but we did not administer the same externalizing and internalizing questionnaires during the pandemic as we did before the outbreak of the pandemic and thus were unable to make direct comparisons between two administrations. Despite its limitations, one advantage of using this approach was that asking participants to draw comparisons before and after the pandemic crisis ensured that the results reflected behavioral changes due to COVID-19, which is the objective of our investigation. Finally, a large number of participants did not complete the COVID-related questions during the limited timeframe shortly after the onset of the pandemic. These participants did not attrit from the study but just failed to complete the COVID measures during the constrained timeframe in which these questions were asked. The COVID-complete and incomplete cases did not differ on any of the non-COVID variables investigated and the sample size meets the minimum requirement as shown by the presented power analysis.

Despite these and other potential limitations, ours is the first attempt to use LH theory to examine changes in youth externalizing and internalizing problems as a result of the COVID-19 pandemic. The evolutionary LH approach is highly relevant for such an investigation because LH strategies that have been formed by environmental adversities (e.g., COVID-19) throughout evolution continue to respond to the safety conditions of present-day living environments and regulate human behavior. Slow LH strategies that have been the hallmark of human evolutionary success still prove to be adaptive in alleviating youth externalizing and internalizing difficulties during the COVID-19 pandemic.

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Table 1. Means, Standard Deviations, and Correlations of Variables used in the Study

	1	2	3	4	5	6	7	8	9	10	11
Environmental Adversity											
1 Unsafe Neighborhood	-										
2 Negative Life Event	.23***	-									
3 Chaos at Home	.30***	.26***	-								
4 Family Income Change	.16*	.23***	.08	-							
Slow Life History Strategy											
5 Insight, Planning & Control	-.09	-.09	-.27***	-.01	-						
6 Parent-Child Relationship	-.34***	-.17*	-.31***	-.17*	.39***	-					
7 Family Support	-.06	.02	-.21**	-.10	.46***	.31***	-				
8 Social Support	-.17**	-.12 [†]	-.25***	-.09	.51***	.52***	.37***	-			
9 General Altruism	-.33***	-.15*	-.13*	-.12 [†]	.26***	.30***	.24***	.38***	-		
COVID-19 Adjustment											
10 Increase in Externalizing	.13	.18*	.14 [†]	.07	-.23**	-.19*	-.23**	-.21*	-.12	-	
11 Increase in Internalizing	-.03	.07	.18*	.18*	-.14	-.16*	-.21*	-.24**	-.14 [†]	.56***	-
Mean	0.43	0.14	2.25	2.65	3.90	3.79	4.31	4.61	2.51	1.90	2.48
SD	0.44	0.15	0.55	0.81	0.62	0.27	0.36	0.56	0.37	0.82	0.91

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

Table 2. *Gender and Ethnicity Breakdown of Variables Used in the Study*

	Gender			Ethnicity			
	Male	Female	<i>t</i>	European American	African American	Latino	<i>F</i>
Environmental Adversity							
Unsafe Neighborhood	0.43 (0.43)	0.43 (0.46)	0.10	0.22 (0.19)	0.58 (0.55)	0.54 (0.47)	11.63***
Negative Life Event	0.12 (0.15)	0.15 (0.15)	-1.24	0.10 (0.13)	0.19 (0.17)	0.18 (0.15)	4.49*
Family Chaos	2.24 (0.54)	2.26 (0.56)	-0.33	2.25 (0.67)	2.29 (0.46)	2.15 (0.50)	0.59
Family Income Change	2.67 (0.77)	2.62 (0.86)	0.56	2.90 (0.70)	2.54 (0.73)	2.29 (0.88)	7.89**
Slow Life History Strategy							
Insight, Planning & Control	3.91 (0.56)	3.88 (0.69)	0.42	3.76 (0.53)	4.06 (0.76)	3.89 (0.67)	2.22
Parent-Child Relationship	3.80 (0.26)	3.77 (0.29)	0.85	3.83 (0.18)	3.75 (0.29)	3.78 (0.27)	1.50
Family Support	4.33 (0.36)	4.29 (0.36)	0.79	4.21 (0.30)	4.33 (0.39)	4.39 (0.38)	3.44*
Social Support	4.56 (0.51)	4.66 (0.61)	-1.49	4.60 (0.60)	4.56 (0.71)	4.56 (0.55)	0.54
General Altruism	2.48 (0.33)	2.55 (0.41)	-1.33	2.59 (0.32)	2.52 (0.34)	2.41 (0.42)	3.12*
COVID-19 Adjustment							
Increase in Externalizing	1.78 (0.73)	1.99 (0.88)	-1.51	1.74 (0.79)	2.12 (0.79)	1.76 (0.84)	3.44*
Increase in Internalizing	2.14 (0.80)	2.76 (0.91)	-4.26***	2.27 (0.86)	2.68 (0.90)	2.40 (0.93)	2.46

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

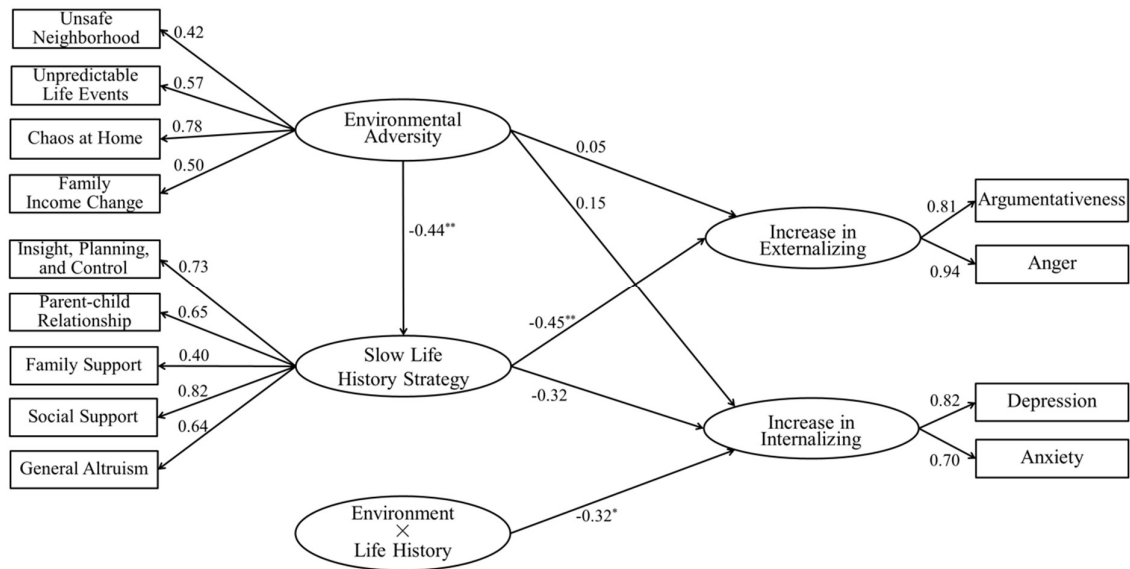


Figure 1. Childhood environment and LH strategies before COVID-19 in relation to increase in externalizing and internalizing during the pandemic.

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

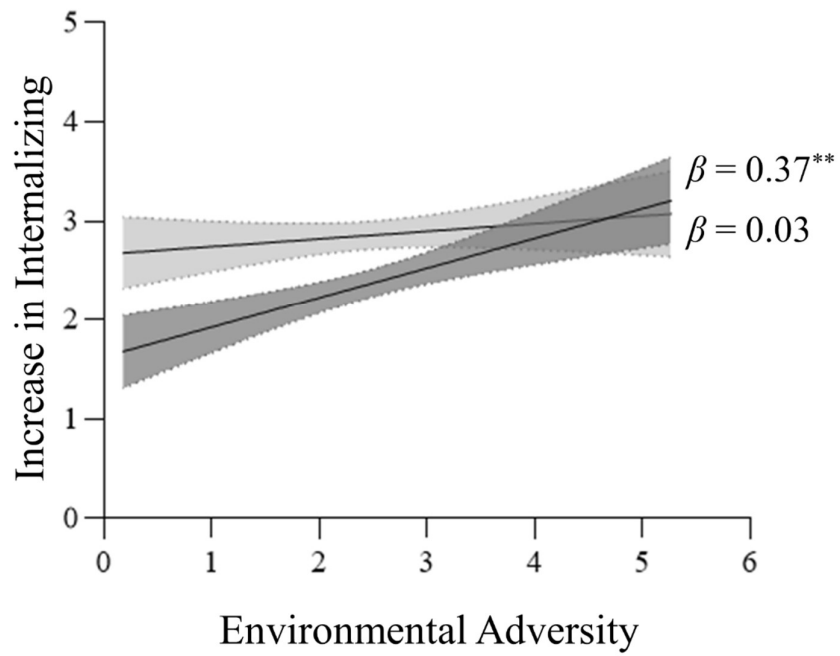


Figure 2. Simple slopes and 95% confidence bands of the regression of increase in internalizing on childhood environmental adversity at 1 SD above (light) and 1 SD below (darkened) the mean of slow LH strategy.