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Resource and extrinsic risk in defining fast life histories of rural Chinese left-behind children

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Resource and Extrinsic Risk in Defining Fast Life Histories of Rural Chinese Left-Behind Children

Abstract

Food and safety are essential for survival and their environmental constraints, levels and variations of resources and extrinsic risks shape life history (LH) trade-off strategies. Based on a longitudinal sample of 206 Chinese adolescents living in rural areas, half of whom were children living with older relatives away from their migrant worker parents, this study is one of the first to test how both resources and extrinsic risks effect LH strategies. Structural equation modeling and other correlational results showed that the environmental constraints of safety and food were negatively and positively, respectively, associated with slow LH strategy, which in turn was negatively associated with pubertal status as well as such behavioral outcomes as present orientation, impulsivity, risky and externalizing behavior, and academic underperformance. The puberty-inducing effects of paternal and biparental absence were also observed. These results support the evolutionary conception that human development responds to environmental cues about resources and extrinsic risks in regulating LH and behavior.

Keywords: Fast and slow life history; resource; extrinsic risk; competition; parental absence; father absence

Food and safety are essential for survival. Their acquisitions are constrained by the environment resulting in different levels and fluctuations of resources and different rates and stochastic variations of extrinsic risks, all of which shape birth rates and death rates (Brown & Sibly, 2006) and life history (LH) trade-off strategies (Ellis, Figueredo, Brumbach, &

Schlomer, 2009). These two sets of environmental conditions that drive intraspecific (e.g., Lucas, 2011) and interspecific (e.g., Sibly & Brown, 2007; Wilbur, Tinkle, & Collins, 1974) differences in LH have been extensively studied in other animals. However, human LH studies have focused only on one environmental condition, partly because the relatively uniform modern day living environment limits sufficient variation in food and resources, especially at the survival threshold level (Chang & Lu, 2017). The present study employed a special population, namely "left-behind" children in rural China, to expand the variations of resources and extrinsic risk and investigate their effects on human LH and development.

China has nine million left-behind children, referring to those who have remained in their rural hometowns after both parents have moved to cities to seek employment as migrant workers (Ministry of Civil Affairs of China, 2016). Such children do not always live with their parents from as early as their birth and for as long as their entire childhoods (National Women's Confederation, 2013). During the long period of parental absence, they live with older relatives such as grandparents and often change residence to live with different family members. Such children usually come from the poorest rural regions in China, which have high population densities and few economic opportunities. However, these rural regions tend to have strong traditional values, few sociocultural changes, and relatively stable family structures. In this wider context of high sociocultural stability and few economic resources, left-behind children are provided with windfalls of abundant resources as a result of the higher city wages remitted by their migrant parents, while facing the disruption of family stability by becoming parentless. A comparison of left-behind children with those who live with both parents and with limited economic means but high family stability provides a wide range of environmental conditions to examine the LH of these children as functions of resources and extrinsic risk.

Human LH Research and the Missing Link

Conventional LH models of organism development incorporate two sets of environmental conditions to predict a fast versus slow LH trade-off strategy and related physiological and psychological outcomes (Sibly & Brown, 2007). One set comprises resource levels and fluctuations, which are density dependent as defined by the r-K selection theory (Ellis et al., 2009; MacArthur & Wilson, 1967; Pianka, 1970; Reznick, Bryant, & Bashey, 2002; Rushton, 1985). The other set comprises the rates and stochastic variations of extrinsic risks such as predation, disease, and intraspecific violence, all of which cause mortality and morbidity independently of individuals' survival efforts (Ellis et al., 2009). These effects are age-specific and are derived from the fast–slow LH framework (Ellis et al., 2009; Promislow & Harvey, 1990; Stearns, 1992). When resources are sufficient for supporting organisms living in a specific habitat or when they fluctuate under good and bad conditions, species under good conditions tend to freely exploit these rich resources for rapid development and early reproduction to produce many offspring, who subsequently receive little parental investment in terms of teaching and learning because they can survive and thrive in a resource-rich, competition-free environment (MacArthur & Wilson, 1967; Pianka, 1970). When the high reproductive rate increases the population density to the point that resources become limited, a species adopts a slow LH strategy, which involves shifting energetic investment from mating and offspring quantity to nurturing select high-quality young, who adopt slower development to learn the skills required to compete for the limited resources. Similarly, high frequencies and variations of extrinsic causes of mortality and morbidity that are insensitive to the survival efforts of adults or children lead to the adoption of fast LH because natural selection favors accelerated development and reproduction before extrinsic mortality or morbidity occurs (Promislow & Harvey, 1990; Stearns, 1992).

As shown in numerous investigations involving human LH studies (e.g., Doom, Vanzomeren-Dohm, & Simpson, 2016), the contingent coupling of environmental conditions with fast–slow LH trade-off strategies that has been selected during evolution continues to regulate individuals' responses to their current environments (Pepper & Nettle, 2017). The early childhood environment is especially salient in effecting fast–slow LH strategies. Existing human LH studies have focused exclusively on the extrinsic risk dimension of the childhood environment, which is represented by microenvironmental proxies such as low family socioeconomic status (SES) (Belsky, Steinberg, & Draper, 1991), residential mobility (Crowder & Teachman, 2004), homelessness (Herbers et al., 2012), shorter life expectancy (Low, Hazel, Parker, & Welch, 2008), and paternal absence (Belsky et al., 1991). These indicators of early environmental risks have been associated with such fast LH characteristics as early menarche (Belsky et al., 1991), early commencement (Simpson et al., 2012) and high frequency (Baumer & South, 2001) of sexual activity, social deviance and substance use (Brumbach, Figueredo, & Ellis, 2009; Gibbons et al., 2012), aggression and externalizing behavior (Doom et al., 2016; Simpson et al., 2012), and academic underperformance (Obradovic et al., 2009). In particular, paternal absence has been extensively documented as a facilitator of early menarche (Ellis, 2004) and other fast LH manifestations such as problematic behavior (Ellis et al., 2003; Newcomber & Udry, 1987). According to our review of the relevant literature on paternal absence, no study has systematically examined the effects of paternal, maternal, and biparental absence on both girls and boys.

The other environmental condition, resource, has not been empirically investigated in the literature on human LH (Chang & Lu, 2017). A few studies have used childhood family SES to represent resource availability; however, from a conceptual perspective, they have

mistakenly associated resource scarcity with fast rather than slow LH (e.g., Griskevicius, Delton, Robertson, & Tybur, 2011). Most other related studies have examined family SES not as an indicator of resource availability but as one of the potential for extrinsic risks and mortality and morbidity threats (e.g., Belsky et al., 2012; Doom et al., 2016; Ellis et al., 2009; Simpson et al., 2012). This is because most studies have been conducted in urban and metropolitan areas, where family SES represents neighborhood conditions, with low SES associated with drugs, crime, and violence, all of which indicate mortality and morbidity (Pepper & Nettle, 2017). As an indicator of mortality and morbidity, low SES in these studies correlated with fast LH manifestations (Pepper & Nettle, 2017) but not slow LH manifestations, as would be predicted by the resource dimension of an environment. SES did not register the resource-predicted effect largely because, in most of existing studies conducted in resource-rich developed societies, SES variations have mainly occurred in the upper income levels far above the resource-depleting threshold that predicts slow LH (Pianka, 1970; Reznick et al., 2002).

Present Study

In contrast to the findings of previous studies, SES variations in rural China occur mostly at lower economic levels that should provide the necessary range for predicting the fast–slow LH continuum. In rural parts of China that are much smaller in size and more uniform in infrastructure and safety than are the metropolises, SES is unlikely to be confounded by crime or the extent of rundown infrastructure reported in metropolitan areas. The present study investigated family income as an indicator of the resource dimension of the environment and parental absence as an indicator of the extrinsic risk dimension of the environment in effecting LH strategies and related behavioral outcomes. We also examined the rationale that a combination of higher income, indicating sudden resource abundance, and

parental absence, indicating extrinsic risk and unpredictability, sets left-behind children on a fast LH track. The investigations were conducted by testing a model with resource availability and extrinsic risk as two latent constructs associated with the fast LH strategy, which was associated with pubertal status and a latent composite consisting of such fast LH manifestations as present orientation, impulsivity, risky and externalizing behavior, and poor academic performance. By conducting tests on a longitudinal sample of rural Chinese children, half of which were left-behind, we hypothesized that compared with children living in the same village with both parents present, left-behind children not living with either parent exhibited fast LH characteristics of these outcome measures and the early unset of puberty.

Method

Sample and Data Collection Procedure

A community sample was taken from a randomly selected rural county in Henan Province, which registers the highest number of left-behind children (National Women's Confederation, 2013), the highest population density (National Bureau of Statistics, 2016), one of the lowest per capita incomes (National Bureau of Statistics, 2016), and the highest number of high school graduates (China Educational News Website, 2016) and among the lowest divorce rates in China (Su, Liu, & Peng, 2015). Based on power analysis, we targeted 100 left-behind children and 100 non-left-behind children. Left-behind children were defined as those whose parents had been repeatedly absent for at least 6 months per absence for 3 years or longer at the time of the first data collection (Time 1), and non-left-behind children were those who had not been apart from either parent for more than 6 months at a time. The sample obtained in Time 1 contained 109 left-behind (69 male) and 105 non-left-behind (59 male) children, and equal numbers of parent and nonparent guardians. The average ages of

the left-behind and non-left-behind children were 10.78 (standard deviation (*SD*) = 0.74) and 10.69 (*SD* = 0.85), respectively, and those of the guardians were 55.89 (*SD* = 11.29) for left-behind and 44.18 (*SD* = 10.71) for non-left-behind children. The second data collection (Time 2) was conducted 18 months later, when the sample contained 103 (67 male) left-behind and 100 (54 male) non-left-behind children and their guardians. In Time 2, we obtained child behavioral and academic performance measures from the children and their homeroom teachers. The measures discussed below were obtained from the children, their guardians, and their homeroom teachers. For the children and guardians, the Time 1 measures were collected through face-to-face interviews conducted individually between the participants and same-sex interviewers. These were structured interviews where the interviewer helped the participant read the questions and recorded his or her answers. Two interviewers hired from Hong Kong for the Time 1 data collection were blind to the purpose of the study. The interviewers being from a distant and socioculturally distinct place helped to disinhibit honest responses. The Time 2 measures of the children, who were then adolescents, and the homeroom teachers were obtained through self-response questionnaires.

Time 1: Measures of Childhood Resource and Extrinsic Risk

Income per Person. The interviewers helped each guardian to recount and estimate the previous year's annual income from different sources (e.g., various agricultural produce such as crops, vegetables, and farm animals, as well as money remitted by a parent). All sources of income were calculated and the sum was averaged by dividing by the number of family members living on the income.

Perceived Family Resources. We modified six items used in the literature (Griskevicius et al., 2011; sample modified items: our family usually had enough money during my child's growing-up; we often had to borrow money from friends and relatives

during my child's growing-up.) Guardians were individually interviewed to rate the six items on a 6-point scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Negatively worded items were reverse coded in the direction of perceived resource availability. The internal consistency reliability estimate was 0.72.

Child-Perceived Provisioning. Children were interviewed with 10 questions that we created to measure this construct on a 6-point scale ranging from 1 (*completely untrue*) to 6 (*completely true*) (e.g., when I was growing up, I always had three meals a day; I often felt hungry; I had more pocket money than other children.) Negative items were reverse coded in the direction of perceived provisioning. The internal consistency reliability estimate was 0.75.

Exposure to Mortality and Morbidity. The interviewers asked each child to recall the number of times he or she was exposed to death, injury, serious illness, accidents, or other traumatic events. Following the literature (e.g., Miller et al., 2001), the total number of recalled events was used to indicate this construct.

Child-Perceived Stress. We compiled 12 items from the literature (e.g., Goodman, 1997) to measure this construct (e.g., When I was growing up, they (my parents or people I lived with) fought a lot; they were not around; we always had dinner together). The items were rated on a 6-point scale ranging from 1 (*none of the time*) to 6 (*all of the time*). Items were worded or reversely coded in the direction of perceived stress. The internal consistency reliability estimate was 0.62.

Chaos at Home. We adapted and modified 10 items from the Confusion, Hubbub, and Order Scale (Matheny Jr et al., 1995) to measure confusion, chaos, and disorder at home (e.g., when the child was growing up, our home was always like a zoo; we were totally disorganized; our day-to-day activities were orderly). The guardians responded to these questions on a 6-point scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*) to describe the family's home environment when the child was growing up. Items were worded

or reversely coded in the direction of chaos and disorder. The internal consistency reliability estimate was 0.83.

Biparental, Paternal, and Maternal Absence. Each guardian estimated the amount of time that one or both parents spent away from the child for instances of 6 months or longer.

Time 2: Measures of Puberty, LH Strategy, and Fast LH Outcome

Pubertal Status, Onset of Menarche, and Age of Menarche. Pubertal status was measured using the Pubertal Development Scale (Petersen et al., 1988), a widely used self-report measure of physical development that is correlated with evaluations of pubertal development derived from physical examinations (Brooks-Gunn, Warren, Rosso, & Gargiulo, 1987). The questions were rated on a 4-point scale ranging from 1 (*development not yet started*) to 4 (*development already completed*). Adolescents of both genders were asked about their body hair development, growth spurts, and skin changes. Boys were asked to report on facial hair development and voice changes, whereas girls reported on breast development and commencement of menstruation. The menstruation question was a yes/no question, for which girls who answered "yes" were asked to report the age of menarche. The mean of the five questions for boys and four questions, excluding the yes/no question, for girls formed an overall pubertal status, with high numbers representing more advanced pubertal development. The internal consistency reliability estimate was 0.63 for boys and 0.61 for girls; 69.51% of the girls (n = 57) had started menstruation, with the mean menarcheal age being 12.16 years (SD = 0.79).

Mini-K. The adolescents were given a 20-item scale to measure the behavioral and cognitive aspects of LH strategies on a single continuum in the direction of slow LH (Figueredo et al., 2006). Some items were modified to better fit the Chinese rural adolescent population (e.g., I have a close relationship with my primary caregiver; I believe love is based

on emotional closeness more than physical attraction). The items were rated on a 6-point scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). The internal consistency reliability estimate was .77.

Present Orientation. Future orientation was measured using nine items from a self-report measure of future orientation (Steinberg et al., 2009). Each item was presented as a pair of two statements separated by "but"; for example, "some people like to think about all the possible good and bad things that can happen before making a decision, but others do not think it is necessary to consider every possibility." Each adolescent was asked to select one statement that best matched him or her and rate it on a 2-point scale (1 = *somewhat true* and 2 = *completely true*). An item consisting of two statements was thereby rated on a 4-point scale (2 x 2 points). Higher scores indicated greater future orientation. For consistency with other measures of fast LH behavior in the analysis, we reverse coded the items so that higher scores represent present orientation. The internal consistency reliability estimate was 0.72.

Impulsivity. The adolescents were given 18 items selected from the 34-item Barratt Impulsiveness Scale (Patton, Stanford, & Barratt, 1995). The same set of 18 items was used in one previous study on 10–13-year-old adolescents to measure a single factor (Steinberg et al., 2009; e.g., I act on the spur of the moment; it is hard for me to think about two things at the same time). The 18 items were rated on a 4-point scale ranging from 1 (*never true*) to 4 (*always true*). The internal consistency reliability estimate was 0.71.

Risky Behavior. Following the literature (e.g., Galvan et al., 2007), we adapted a self-report measure of risk processing (Benthin, Slovic, & Severnson, 1993). The adolescents were asked about the following nine scenarios involving risky behavior: smoking cigarettes, drinking alcohol, vandalizing property, going to dangerous places, riding in cars with drunk drivers, having unprotected sex, stealing from stores, engaging in gang fights, and using weapons to threaten someone. Each adolescent was asked five questions on each scenario,

rated on a 4-point scale based on the following questions: "How often did you do the activity?" (1 = *never;* 4 = *five or more times*); "How scary are the things that could happen?" (1 = *not scary at all;* 4 = *very scary*); "To what extent are you at risk of something bad happening?" (1 = *very much;* 4 = *not at all*); "How would you compare the benefits of this activity with the risks?" (1 = *the risks are far greater than the benefits;* 4 = *the benefits are far greater than the risks*); "If something bad happened because of this activity, how serious would it be?" (1 = *not at all serious;* 4 = *very serious*). A summary of five ratings for nine scenarios formed the construct, with a higher score indicating a greater degree of risky behavior. The internal consistency reliability estimate was 0.95.

Externalizing Behavior. The home classroom teachers reported on the behavioral problems of each adolescent by using 16 items selected from the Youth Report of Behavior Checklist (Achenbach, 1991; e.g., got into fights; cut class; caught bullying others). A 6-point frequency rating scale was used, ranging from 1 (*never*) to 6 (*20 or more times*). The internal consistency reliability estimate was 0.90.

Academic Underperformance. The home classroom teachers rated their students in Chinese, mathematics, and overall academic performance using a 5-point scale ranging from 1 (*bottom 10% of the class*) to 5 (*top 10% of the class*). In the analysis, we reverse coded the three assessment items so that a higher score represented academic underperformance. The average of the three ratings formed the academic underperformance construct. The internal consistency reliability estimate was .96.

Results

Table 1 presents the means, SDs, and correlations of the variables used in this study. The correlations were moderate in part because they were based on cross-informant (i.e., child, guardian, and teacher) and cross-time data (i.e., 18-month lag). As expected, the sets of

resource (i.e., family income, perceived family resource, and child-perceived provisioning) and extrinsic risk (i.e., mortality-morbidity exposure, chaos at home, child-perceived stress, and biparental absence) variables were all significantly correlated with mini-K representing slow LH strategy which, in turn, was negatively correlated with the full set of fast LH outcome variables including pubertal status.

We used the individual variables and item parcels as indicators in SEM analysis to examine the structural relationships among the environmental conditions, LH strategy, and behavioral and pubertal outcomes. The model is depicted in Figure 1. We measured pubertal status as a directly observed variable and all other variables as latent constructs. For slow LH Strategy, we used three randomly formed mini-K item parcels as reflective indicators of the construct. Item parceling has been used extensively as an effective data simplification method when the underlying construct is unidimensional (Little, Cunningham, Shahar, & Widaman, 2002), as was mini-K in this study. For the other latent constructs, we used stand-alone measures and constructs as indicators. The SEM results reported in Figure 1 show adequate goodness of fit for the data (χ^2 (96, n = 203) = 159.58, $p < .001$, comparative fit index = 0.89, Tucker–Lewis index = 0.85, root mean square error of approximation = 0.05, standardized root mean square residual = 0.06). The χ^2 test was significant but the χ^2-to-degree of freedom ratio (χ^2/df = 1.66) was adequate, even according to the more stringent criterion (Kline, 1998).

The two environmental conditions (resources and extrinsic risk) were both substantially associated with mini-K which, in turn, was significantly associated with the expected behavioral and pubertal outcomes. The two direct paths leading from the two environmental conditions (resources and extrinsic risk) to the two outcomes (behavioral and pubertal) were also marginally significant in the present model. These paths were much more

significant or substantial ($\beta = 0.36$, $p < .05$ and $\beta = 0.53$, $p < .001$, for resource and extrinsic risk on behavioral outcome; $\beta = 0.05$, *n.s.* and $\beta = 0.26$, $p < .05$, for resource and extrinsic risk on pubertal outcome) in a separate model that did not include the indirect effect through the mediation of mini-K. These analyses demonstrate that the two environmental conditions influenced LH in the same direction either directly through diffused effects on behavioral outcomes and pubertal status or indirectly by shaping LH strategies that in turn regulate behavior.

We compared left-behind and non-left-behind children on the set of fast LH outcome variables, as well as family income and parental absence measures, by conducting 2 (left-behind vs. non-left-behind) × 2 (gender) ANOVA that separated out gender and the interaction effects (Table 2). As predicted, the left-behind children scored significantly higher on all of the fast LH outcomes. Compared with the non-left-behind children, the left-behind children experienced much higher income and longer parental absence, and they also showed more advanced or faster pubertal development. The proportion of girls reporting menarche was higher among the left-behind children, and such girls experienced menarche earlier than those in the group of non-left-behind children. Some pubertal tests were not statistically significant because they were based on each gender separately with reduced power.

Because we had three separate measures of parental absence (paternal, maternal, and biparental absence), we could compare the effects of all three on pubertal development. We correlated pubertal development measures with the three parental absence measures (Table 3). The correlations were all in the expected directions. These zero-order correlation results overlapped because biparental absence was highly correlated with paternal and maternal absence. Subsequently, we coded the three continuous measures of parental absence into four

exclusive categories of paternal absence, maternal absence, biparental absence, and parental presence. We conducted planned contrasts by comparing each of the three parental absence groups with the parental presence group (Table 4). Taken together, the results suggested that parental absence had an effect in accelerating sexual maturation. This effect was slightly stronger when both parents were absent than when only one was absent. Furthermore, the results indicated that paternal but not maternal absence had an effect on girls' pubertal development. Some of these tests were not statistically significant, mainly because the analyses were based on the two genders separately with considerably reduced power, particularly for girls, who represented less than 40% of the sample.

Discussion

An LH approach to human development views behavior as the result of the coordinated tuning of multiple physiological (e.g., endocrine, hemostasis, and immunity) and psychological (e.g., neural-cognitive, emotional, and attitude and belief) systems in response to energetic trade-off allocations imposed by environmental constraints (Del Giudice, Gangestad, & Kaplan, 2015). Two overarching and evolutionarily recurrent environmental constraints are food and safety, the levels and variations of which shape physiologically and psychologically coordinated LH trade-off strategies and related behaviors. Central to different LH trade-offs is the trade-off between fast and slow LH, which differ in the pace and intensity of completing maturation and engaging in reproduction. When the resource level is high, when it varies under good and bad conditions, especially when sudden unexpected resource abundance occurs, organisms opt for fast LH strategies to exploit the competition-free or competition-easing resources for fast development. Left-behind children face sudden resource abundance from city wages remitted by their migrant worker parents, who normally earn double or triple of what they would in their rural hometowns (Cong &

Zhang, 2015). That the earners (i.e., parents) and spenders (i.e., children and their nonparent guardians) are different people severs the potential association between competition and resources, thereby further easing the negative effect of competition and enhancing the positive effect of rich resources on fast LH. In an otherwise resource-depleting environment with a low gross domestic product and high population density (National Bureau of Statistics, 2016), sudden windfall payments providing economic affluence should set left-behind children on a fast LH track. The other environmental constraint (parental absence as a threat to safety) similarly enacts fast LH to accelerate maturation and reproduction before mortality or morbidity occurs. Predation represented one of the most serious threats to safety in the evolutionary past (Bowlby, 1972), whereas prolonged parental absence and the associated child-perceived stress echo the same level of severity in modern living. Thus, the unfortunate phenomenon of rural Chinese left-behind children provides an opportunity to test LH theories. The findings that left-behind children scored higher than non-left-behind on fast LH outcomes including earlier pubertal development and both sets of resource and extrinsic risk variables predicted LH strategies in the same expected directions provide a comprehensive test of the relationship between environment and LH development. In testing this LH model, the present study made two contributions to the literature.

First, the present study provides a rare opportunity to examine the effects of paternal, maternal, and biparental absence on boys' and girls' pubertal development. Previous studies have focused mainly on paternal absence and girls' maturation (Ellis, 2004). Such studies have determined that the psychosocial stress experienced by girls without fathers is mainly exacerbated by three potential stressors, namely parents' divorce, which used to be and may still be stigmatized (Draper & Harpending, 1988), the loss of a major resource source due to the disappearance of the father (Belsky et al., 1991), and mating-related distress and

distraction on the part of the mother (Ellis, 2004). Parental absence due to distant employment was the norm in the villages where the present study was conducted. Such absence was associated with increased resources and was unrelated to marital distress. Without the usual stressors, particularly resource shortage, the present findings narrow the causative factors of accelerated maturation down to direct parental care. In addition, the much weaker puberty-inducing effect of maternal absence than of paternal or biparental absence suggests that direct paternal care, a characteristic of human pair-bonding evolution (Geary, 2000), is likely one of the most crucial factors in setting human children on LH trajectories.

Second, this study is one of the first to investigate the resource dimension of the environment, use income to indicate resources, and theorize the positive relationship between high income and fast LH. By contrast, previous LH studies have all treated income and SES as indicators of the extrinsic risk dimension of the environment and have reported negative relationships of these indicators with fast LH (i.e., low SES is related to fast LH). There are several explanations for existing findings seeming different from ours. Previous studies have been almost exclusively conducted in economically developed and metropolitan locations, where low SES is often associated with violence, crime, and drugs, all of which represent extrinsic risks. Therefore, the effect of extrinsic risks has been registered in previous studies. In developed economies, low SES exhibits little downward variation and is far above the resource-depleting threshold required to enact slow LH. Moreover, high SES is closely tied to competition (e.g., education and other institutionalized means of self-advancement), whereas low SES is more detached from competition (e.g., welfare is noncompetitive), which is the most crucial component in density-dependent selection for defining the relationship between resources and LH (i.e., high competition is related to slow LH and low competition is related to fast LH). Taken together, because of the socioeconomic characteristics of previous study

sites, low SES has represented extrinsic risks but not resources and has been associated with fast but not slow LH (Pepper & Nettle, 2017). Consequently, the literature has neglected the resource dimension of the two-dimensional environment in human LH investigations.

Food and safety are the two environmental constraints that drive LH trade-offs and the evolution of species. However, since John Bowlby's conscious selection of safety over food for studying attachment (Bowlby, 1972), psychology has focused on safety and has excluded food partially because food, resources, and provisioning exhibit little downward variance in modern life. By analyzing a unique population, we were able to include food (resource) and safety (extrinsic risk) in our LH investigation. However, similar to previous studies, our investigation was limited by not including in the LH model competition, which is key to density-dependent selection (Birch, 1957; Nicholson, 1954), serves as the driver of human evolution, and is likely to mediate most environmental effects on human LH (Chang & Lu, 2017). "Humans had in some unique fashion become so ecologically dominant that they in effect became their own principal hostile force of nature," and "nothing would select more potently" "than a within-species co-evolutionary arms race in which success depended on effectiveness in social competition" (Alexander, 1990, pp. 4–7). Future LH studies should initiate investigation into competition at the individual and population levels to examine how it mediates the relationship between resources and LH and directly affects LH.

Our study was limited by a small sample size involving fewer girls than boys and by 30% of the girls not yet having experienced menarche. We targeted the migrant worker population to study left-behind children. Hence, in cases where only one parent had left home to become a migrant worker, the leaving party was usually the father, resulting in fewer children with maternal absence than those with paternal absence. Although we investigated

boys and girls, we did not obtain spermarche data. In addition, we did not obtain anthropometric data, which could have been used to more effectively examine the effects of resources and energetic provisioning. Most notably, our results, particularly some of the factor loadings, were moderate. Despite our efforts to use multidimensional and multi-informant measurements, some of the measurements used and the overall psychometric approach adopted to define LH strategies may not have fully represented the construct and its processes, both of which would be more comprehensively illuminated through biometric and psychometric observations. Additionally, we emphasized the importance of resources and competition in defining LH partially because these variables should be but had not yet been systematically investigated. However, we also acknowledge that extrinsic risk and age specificity in selection are more relevant than resource and density-dependent selection, particularly in shaping modern human LH (Ellis et al., 2009). Finally, we did not control for potential genetic influences on LH (Braendle, Heyland, & Flatt, 2011; Kirk et al., 2001), which could have contributed to the observed fast LH manifestations in the left-behind children and their parents' leaving them. However, labor outflow from poor rural regions has become such a prevailing social force that it is only a matter of time before entire villages leave to seek employment in the cities, leaving seniors and children behind (Li, 2010; Wang, 2016). Thus, individual difference variables including genetics should have more muted confounding effect. Despite these limitations, this is one of the first studies to examine all three types of parental absence in a Chinese sample and one of the first to explore the resource and extrinsic risk dimensions of the environment in engendering LH strategies and related behavioral and physical outcomes. The findings of this study could help to expand the scope of existing empirical human LH investigations and their theoretical frameworks.

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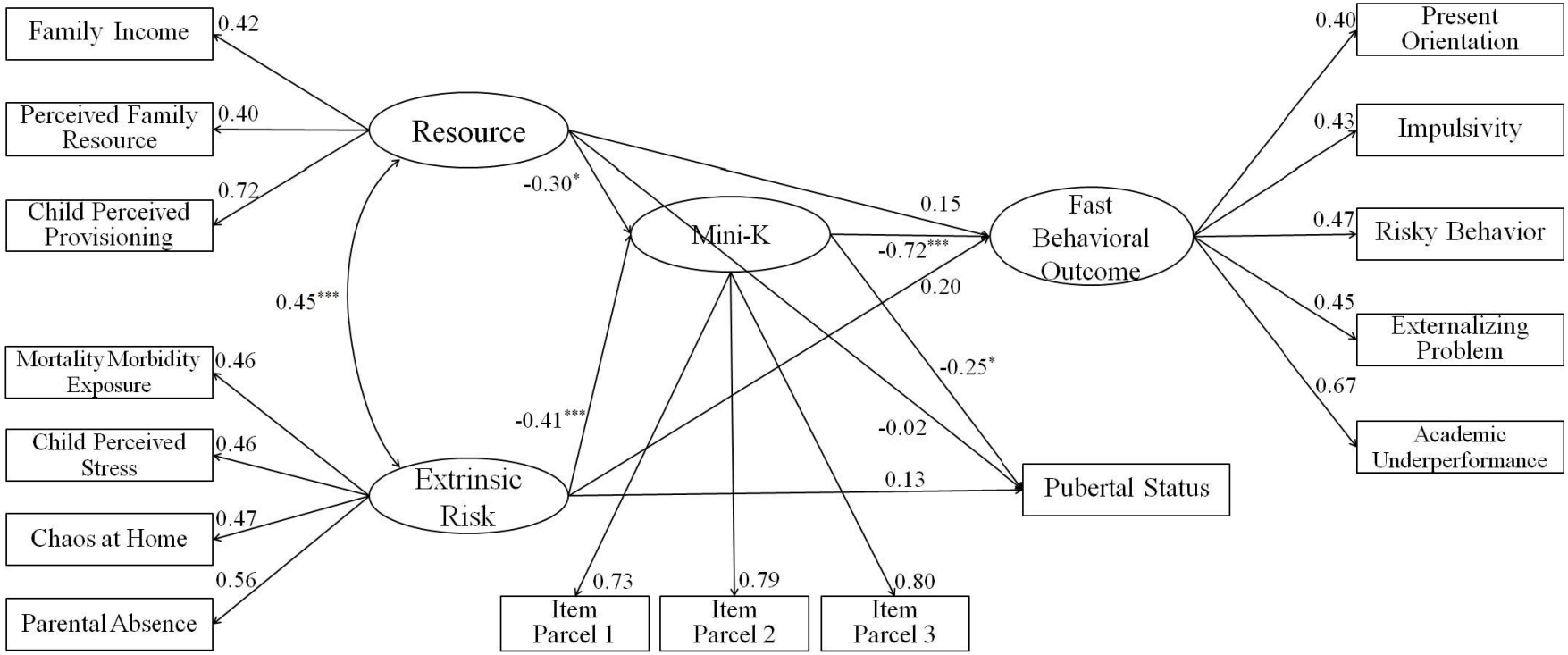

Figure 1.

Resource and Extrinsic Risk in Predicting LH Strategy and Physical and Behavioral Outcome

†<.10; *<.05; **<.01; ***<.001

Table 1.

Means, SDs, and Correlations of the Variables Used in the Study

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Family Income	-													
2. Perceived Family Resource	0.17*	-												
3. Child Perceived Provisioning	0.30***	0.29***	-											
4. Mortality-Morbidity Exposure	0.09	0.12†	0.15*	-										
5. Child Perceived Stress	0.09	0.09	0.20**	0.29***	-									
6. Chaos at Home	0.09	0.25***	0.15*	0.30***	0.22**	-								
7. Parental Absence	0.15*	0.17*	0.18**	0.26***	0.28***	0.26***	-							
8. mini-K	-0.24***	-0.20**	-0.35***	-0.25***	-0.30***	-0.29***	-0.30***	-						
9. Present Orientation	0.10	0.10	0.17*	0.12†	0.12†	0.25***	0.20**	-0.36***	-					
10. Impulsivity	0.12	0.11	0.25**	0.13†	0.13†	0.14*	0.27***	-0.39***	0.17*	-				
11. Risky Behavior	0.17	0.11	0.23**	0.14*	0.14*	0.15*	0.24***	-0.43***	0.31***	0.21**	-			
12. Externalizing Problem	0.11	0.12	0.19**	0.14*	0.14*	0.17*	0.17*	-0.40***	0.20**	0.20***	0.30***	-		
13. Academic Underperformance	0.17*	0.19**	0.30***	0.20**	0.20**	0.28***	0.29***	-0.60***	0.20***	0.33***	0.32***	0.30***	-	
14. Pubertal Status	0.08	0.07	0.12	0.12†	0.12†	0.14*	0.18**	-0.31***	0.12†	0.13†	0.14†	0.13†	0.20*	-
Mean	32429	3.57	2.96	1.34	1.72	3.93	3.70	4.06	2.59	2.15	1.67	0.27	1.75	2.07
SD	27257	0.43	0.47	1.81	0.57	0.98	3.73	0.69	0.49	0.39	0.49	0.43	1.23	0.48

*<.05; **<.01; ***<.001

Table 2.

Comparison between Left-behind and Non-left-behind Children on Fast Life History Outcome

	Left-behind Children		Non Left-behind Children		*F*-test Left-behind main effect	*F*-test Gender main effect	*F*-test Interac-tion
	Mean	*SD*	*Mean*	*SD*			
Family Income	36279	29414	28380	24285	4.95*	0.07	1.06
Perceived Family Resource	3.05	0.45	2.86	0.47	7.03**	1.31	0.04
Child Perceived Provisioning	3.63	0.37	3.50	0.48	4.28*	3.08	0.15
Mortality-Morbidity Exposure	1.64	2.04	1.03	1.46	6.76*	1.55	1.29
Child Perceived Stress	1.85	0.68	1.59	0.38	7.97**	6.09*	5.65*
Chaos at Home	4.11	1.07	3.76	0.86	5.90*	4.20*	0.01
Absent Time of Father	8.25	1.41	2.89	3.86	174.12***	1.03	0.95
Absent Time of Mother	7.19	2.01	1.33	2.69	307.42***	3.02	0.14
Absent Time of Both Parents	7.05	2.02	0.25	0.67	1017.42***	1.87	1.35
Mini-K	3.86	0.71	4.26	0.62	14.41***	6.39*	0.23
Risky Behavior	1.82	0.53	1.52	0.39	19.28***	0.01	1.23
Impulsivity	2.26	0.43	2.04	0.30	12.22***	7.29**	4.26*
Externalizing Problem	0.35	0.43	0.19	0.42	4.11*	7.72**	0.51
Present Orientation	2.69	0.47	2.50	0.50	8.12**	1.17	0.83
Academic Underperformance	2.18	1.19	1.31	1.11	21.61***	5.48*	2.80
Pubertal Status	2.15	0.42	2.00	0.52	6.79**	5.07*	0.29
Age of Menarche	12.00	0.86	12.31	0.71	2.21		
Percentage of Menarche	77.78%		63.04%				

*<.05; **<.01; ***<.001

Table 3.

Correlations Between Parental Absence and Pubertal Development

	Parental Absence		
	Paternal	Maternal	Bi-parental
Pubertal Status of Boys	0.23*	0.15	0.21*
Pubertal Status of Girls	0.36***	0.08	0.21†
Age of Menarche	-0.14	-0.21	-0.27*
Percentage of Menarche	0.23*	0.14	0.19†

***<.001; *<.05; †<.10

Table 4.
Pubertal Development Differences between Parental Absence and Presence

	Pubertal Status of Girls			Pubertal Status of Boys		
	Mean	*SD*	*t*-test	*Mean*	*SD*	*t*-test
Bi-Parental Presence	1.96	0.58		1.89	0.44	
Paternal Absence	2.31	0.51	2.25*	2.16	0.56	1.94†
Maternal Absence	1.70	0.45	-1.07	1.82	0.37	-0.43
Bi-Parental Absence	2.27	0.42	2.41*	2.08	0.40	2.08*

	Age of Menarche			Percentage of Menarche	
	Mean	*SD*	*t*-test	Percentage	χ^2
Bi-Parental Presence	12.36	0.84		58.33%	
Paternal Absence	12.17	0.58	-0.61	70.59%	3.69†
Maternal Absence	12.67	0.58	0.61	60.00%	0.08
Bi-Parental Absence	12.00	0.86	-1.37	77.78%	9.19**

**<.01; *<.05; †<.10