Concern about COVID-19 mediates the relationship between life-history strategy and stockpiling food but not wanting children

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1. Introduction

Life history theory (LHT) provides a framework for understanding how environmental conditions shape an organism's life history trajectory – that is, their rate of maturation, reproductive age and number of offspring (Hill 1993; Kaplan & Gangestad, 2004). Due to the limited availability of finite resources, organisms make trade-offs between allocating energy to reproducing either sooner or later, which are shaped by the status of the environment (MacArthur & Wilson, 1967). In dangerous environments where resources are unreliable, resource allocation should favour a fast life history strategy (LHS) of reproduction and more offspring. In comparison, safe and resource reliable environments should promote a slow LHS of somatic investment and delayed reproduction in favour of fewer offspring (Pianka, 1970). Either strategy is adaptive, conferring advantage in the corresponding environment.

LHT initially elucidated species level LHS differences in non-human animals, although has latterly been utilised in contextualising individual differences in human reproductive scheduling (for a review, c.f. Black et al., 2017). For example, one particular focus concerns suboptimal childhood experiences such as stress, low quality parental attachment and father absence, which are as expected, connected to fast LHS reproductive scheduling markers such as faster maturation rate, increased number of sexual partners and lower age at first child (Belsky et al., 2012; Draper & Harpending, 1982; Dunkel et al., 2015; Moffitt et al., 1992; Simpson et al., 2012; Szepsenwol et al., 2015). From an evolutionary psychological perspective, personality and other dispositional traits should be co-selected and arise such that they operate complimentarily in facilitating an individual's LHS. This suite of traits has been latterly defined as Pace of Life Syndrome (POLS) (Dammhahn et al., 2018; Nettle & Frankenhuis, 2019), which there is evidence for. For example, slow LHS is associated with conscientiousness, anxiousness and fearfulness, which are traits that indicate

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cautious interaction with the environment as well as a future orientated perspective. In contrast, fast LHS is associated with low agreeableness and sensation seeking which would expose an individual to environmental risk (Brüne, 2016; Mealey, 1995; Sherman et al., 2013; Young et al., 2017). Thus, people appear to think and behave teleologically with respect to their LHS. Furthermore, evolutionary fitness is afforded by the ability to respond to temporal and spatial shifts in the environment, therefore even though an individual's LHS is established during childhood, it makes adaptive sense for their POLS to acclimatise to circumstances occurring in adulthood. Indeed, such is phenotypic plasticity crucial to survival as well as effective parenting that it would be expected to endure throughout the life course (Trivers, 1972; Wilson & Daly, 1997). We would therefore expect POLS related behavioural alterations in adults exposed to shifts in environmental conditions, especially when mortality salience prevails. Indeed, behavioural plasticity acting upon childhood and adulthood experiences and current environmental conditions is demonstrated by increased risk taking and non-delayed gratification behaviour in low childhood socio-economic status individuals exposed to mortality salience and resource scarcity (Griskevicius et al., 2013; Mittal & Griskevicius, 2014; Pepper & Nettle, 2013). Like other animals, humans continually monitor the environment throughout the life course for condition contingent signals in order to adapt in ways that optimise survival and reproduction.

The COVID-19 pandemic provides a unique circumstance for probing phenotypic plasticity in the context of heightened existential threat in adult humans. In addition to operating within an environment which has rapidly changed due to the implementation of lockdowns, social distancing and facial coverings, people have also been exposed to chronic and substantial media coverage about COVID-19. Thus, mortality salience has potentially increased, especially in the initial emergence of the virus when it was novel as a concept and death rates were particularly high. Research has already demonstrated how individual

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differences that are proxies for LHS/POLS interplay with cognitive appraisals of and behavioural responses to COVID-19. For example, individuals higher in trait emotional intelligence, emotional stability, creativity & cognitive reserve as well a positive approach to problem solving were able to engage in self-regulated learning strategies more effectively in response to the stress and uncertainty caused by the pandemic (Albani et al., 2023; Fiori et al., 2022; Panico et al., 2022; Zacher & Rudolof, 2021). Being high in neuroticism had the reverse effect (Ikizer et al., 2022). Crucially, those with future oriented consciousness reported engagement with prevention measures and collective action, as well as compassion and concern for others (LaLot et al., 2021). In comparison, people who were more superstitious felt more at risk of catching the virus (Hoffmann et al., 2022), and those who held COVID-19 conspiracy beliefs, were high in impulsivity and low in mindfulness, self-control, trust of scientists and agreeableness were less likely to comply with prevention measures (Cao & Li, 2022; Copping, 2022; Matta et al., 2022; Stosic et al, 2021; Wismans et al, 2021;) although this was mitigated by high trait openness to experience (Li et al., 2023), agreeableness (Choi et al, 2022), conscientiousness (Deng 2021, Krupić et al., 2021) and positive self-schemas (Leibovitz et al, 2021). Neuroticism and dispositional greed were associated with hoarding behaviour although this was also demonstrated in agreeableness and openness (Yoshino et al., 2021). LHS/POLS proxies such as psychological distress, threat sensitivity and paranoia predicted over-purchasing behaviour (Bentall et al., 2021). Research that has examined response to the COVID-19 pandemic in relation to LHT specifically revealed that residents of Wuhan, regarded as the source for the outbreak of the virus, reported a faster LHS (Li & Cao, 2023), and those with a slower LHS took precaution measures (Corpuz et al., 2020). The current study therefore examines the influence of cognitive appraisals of the COVID-19 pandemic on the relationship between LHS/POLS and two LHS/POLS relevant criteria; the desire to have children or more children and stockpiling

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food. Both would be expected to increase in an environment of increased mortality salience. The following predictions are made:

1. A faster LHS/POLS will predict the desire to have children or want more children.
2. A slower LHS/POLS will predict increased food purchasing in response to the pandemic.
3. Slow LHS/POLS will predict increased concerns about COVID-19.
4. In the framework of environmental signalling, increased COVID-19 news consumption will positively predict increased concerns about COVID-19.
5. Concerns about COVID-19 will mediate the relationship between POLS and the desire to have more children and increased food consumption.

2. Method

2.1. Participants and Procedure

Two-hundred and seventy-four (M_{age} = 34.72, SD = 14.47, Female = 202; Male = 69; Non-binary = 1, Prefer not to say = 2) UK participants constituted a convenience sample recruited via social media platforms and Call for Participants, an online platform used for the advertisement of studies to prospective participants. A £50 Amazon gift voucher was offered as an incentive to take part, and the winner was selected randomly from submitted email addresses. Data collection operated between April and May 2020.

The ethnic profile of the sample consisted of 80.7% White; 7.3% Mixed Race; 7.7% Asian; 2.2% Black and 2.2% reported as "Other". The majority of participants were educated to Bachelor's degree (39.4%), followed by A-Level/college (23.7%), Masters (19%), GCSE (School) (8%), PhD (5.5%) and HND/BTEC/vocational equivalent (4.4%). Similarly, 29.6% of participants were students, followed by; 23% Professional; 7.7% Managerial; 6.9%

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Customer Service; 6.2% Retired; 5.8% Unemployed; 5.8% Administrative; 4.4% Associate Professional; 4% Skilled Trade and 1.5% Temporary.

The study was given favourable review by (removed) University Ethics Committee and adhered to the British Psychological Society's Code of Conduct (2018). A brief description of the study was advertised with a link to the study, hosted on Qualtrics. On arriving at the landing page, participants were provided with information detailing the nature of the study and were asked to confirm they were over the age of 18 years old and consented to taking part. Participants completed a series of self-report psychometric measures and questions that took approximately 15 minutes to complete and were subsequently debriefed.

2.2. Measures

Unless otherwise stated, all measures utilised a 5-point Likert scale (1 = strongly disagree, 5 = agree). For all measures, total scores were obtained by averaging across individual items' scores.

Life History Strategy (LHS)/Pace of Life Syndrome (POLS): The *K-SF-42 Short form of the Arizona Life History Battery* (Figueredo et al., 2017) was used, which taps into "behavioural and cognitive indicators of LH resource allocations among different domains of fitness" (p.2). Items are scored using either a 7-point (e.g., disagree strongly, agree strongly) or 4-point (not at all, a lot) Likert scale. A total score was calculated for all items, with a higher score indicating a slower LHS.

All of the following COVID-19 related variables were taken from Priniski & Holyoak (2020). *Perceived coronavirus severity* consisted of 5-items including "COVID-19 is the biggest threat to public health in recent years". A high score represented increased severity perception. *COVID-19 prevention attitudes* was measured by 6-items including "It is important to protect others from COVID-19". Scores were reverse scored, so a higher score reflects increased prevention behaviours. *Intention to vaccinate* consisted of 4-items such as

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"A COVID-19 vaccine will save lives". A high score represents an increased intention to vaccinate *Concerns about contracting COVID-19* - Two items were asked which included "COVID-19 is highly contagious and we must do what we can to prevent its spread". A high score represents increased concern about contracting the virus *Fear of COVID-19* - Seven-items that assesses participant's general fear of COVID-19. Example items include "I am most afraid of coronavirus-19" and "I am afraid of losing my life because of coronavirus-19". A higher score reflects increased fear of COVID-19. *COVID news frequency* - Participants used a 0 - 100 sliding scale (0 = infrequently, 100 = very frequently) to indicate how much COVID-19 related news they were engaging with.

Stockpiling food: Participants were asked "In the last month, to what degree have you purchased more food and household groceries than you would usually? Response options: 'has remained the same', 'slightly more' 'moderately more' considerably more'. A high score represents an increased food purchasing.

Desire to have children/more children: Participants were asked "If you have children, how many more children would you like to have" and "If you don't have children, how many children would you like to have?".

5.3. Analytical strategy

A structural equation model was created to test whether concerns about the pandemic mediated the relationship between LHS scores and both stockpiling behaviour and desire for number of kids. All modelling was conducted in AMOS version 28 (IBM, New York).

Data for two participants were removed as they provided missing data for key variables in the model, with complete datasets needed to calculate bootstrapped indirect effects. This left 272 useable responses.

To test model fit, a range of indices were generated. For the standardised root mean residual (SRMR) values under 0.08 were considered indicative of good fit. The root mean

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square error of approximation (RMSEA) parsimony adjusted measure is reported with values less that than 0.06 considered good fit and values greater than 0.06 but less than 0.08 as acceptable (Hu & Bentler, 1999). The Tucker Lewis index (TLI) and Comparative Fit Index (CFI) were deemed as acceptable above .90 and good above .95 (Hu & Bentler, 1999).

As several measures of concerns about COVID were collected, a separate confirmatory factor analysis (Bollen, 1989) was completed prior to building the SEM. A Maximum Likelihood Estimator was used with the same indices of model fit applied as above for the structural model.

6. Results

Descriptive statistics and correlations are reported in Table 1.

[INSERT TABLE 1 ABOUT HERE]

Latent variable for concern about COVID-19

Several different measures relevant to concerns about COVID-19 were collected (*Concerns about contracting COVID-1; Perceived severity of COVID-19; Prevention spread behaviour; Fear of COVID-19; Intention to vaccinate*). To establish if these might load on to a latent variable for concerns regarding the pandemic, a confirmatory factor analysis was completed. Fear of COVID-19 had a surprisingly low loading of .373, so was removed from further analysis. The model was a good fit for the data (CFI = .999, TLI = .998, RMSEA = .022, SRMR = .015)

Structural equation model

The final model was a good fit for the data (CFI = .953, TLI = 932, SRMR = .073, RMSEA =.059). Direct associations between the variables and hypothesized indirect effects are shown in Tables 2 and 3, respectively. For ease of interpretation, the values in

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Figure 1 are standardized (β) coefficients, whereas those in Table 2 are unstandardized regression coefficients.

[INSERT TABLES 2 AND 3 ABOUT HERE]

[INSERT FIGURE 1 ABOUT HERE]

Desire for children.

Contrary to H_1, instead of a faster LHS/POLS, it was a slower LHS/POLS that directly predicted an increased desire for children (see table 2). However, contrary to H_5, there was no indirect association between LHS/POLS and desire for children (see table 3), meaning that despite environmental signalling about volatile environment conditions, this did not influence peoples' desires to have more or less children. As would be expected, those who were younger desired children or wanting more children.

Recent food purchasing behaviour.

As can be seen from figure 1 and table 2, a slower LHS/POLS did not directly predict buying more food, which had been originally predicted (H_2). As hypothesised however (H_5), an indirect relationship (see table 3) also existed between a slower LHS/POLS and increased food purchases via concerns about COVID-19. As such, if an individual had a slower LHS/POLS and was concerned about the pandemic, they reported stockpiling food demonstrating a pathway through which LHS/POLS influenced this behaviour. The other anticipated direct effects within this pathway were significant, with a slower LHS/POLS directly predicting increased pandemic concern. In turn, greater pandemic concern predicted increased purchasing of food. As was predicted (H_4), increased COVID-19 related news consumption predicted more concern about the virus.

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7. Discussion

At the biological level, LHT describes how reproductive scheduling is up or down shifted according to environmental conditions (Hill 1993; Kaplan & Gangestad, 2004; MacArthur & Wilson, 1967). Correspondingly, POLS denotes the suite of psychological characteristics that facilitate an individual's LHS (Dammhahn et al., 2018; Nettle & Frankenhuis, 2019). From an evolutionary perspective, it is also adaptive to exhibit behavioural plasticity in response to elevated mortality salience (Trivers, 1972; Wilson & Daly, 1997). The unique and abrupt change in circumstances arising from COVID-19 in which people were subject to ubiquitous news coverage of the virus as well as behavioural change in the form of lock downs, social distancing, wearing face masks and increased hygiene practices, have provided the opportunity to examine whether the pandemic bore consequences for POLS related domains. Previous research had already demonstrated relationships between LHS/POLS proxies and behaviour elicited by the pandemic (e.g., Li & Cao, 2023; Corpuz et al., 2020), and the current study sought to broaden this examination further.

Contrary to prediction, the current study revealed that the pandemic did not change people's LHS/POLS in the key domain of wanting or wanting more children, although slower LHS/POLS did directly. Earlier studies have similarly demonstrated trends in the opposite direction to what LHT would predict with respect to slower LHS/POLS individuals engaging in resource demanding and high-emission lifestyles and lower fertility rates being associated with high risk environments in the context of increased future orientation and (Caudell & Quinlan, 2016). Evidently, incongruent variation in LHS/POLS is possible. Furthermore, that the average age of the study cohort was 34 years-old, may reflect postponed reproductive effort that is characteristic of slow LHS/POLS. It could also be the case that families of fast LHS/POLS participants were already complete. This has interesting implications as it

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suggests an optimal window of time for reproductive effort - e.g., where it coincides with a drop off in fertility associated with aging that may not impact those with a slow LHS/POLS in the same way because of somatic investment and resource availability. Beyond a certain point, even with a fast LHS/POLS, individuals may not desire children because it is no-longer an optimal strategy. Alternatively, that COVID-19 concern did not predict wanting nor wanting more children suggests that a shift in LHS/POLS might require considerably more severe environmental change such as living in a warzone. Such a pattern maybe inferred from the post WW2 "baby boomer generation" or increase in Ukraine marriage and pregnancy rates since the outbreak of war (Hyde, 2022). Indeed, there is current debate with regards to how "environmental harshness" can be judged (Stearns & Rodrigues, 2020) and the decision to have a child is highly complex due to the time and resource investment involved.

In contrast and this time in line with predictions, slower LHS/POLS individuals purchased extra food when they reported higher COVID-19 concern, which suggests a behavioural reaction to the existential threat posed by the virus. These findings dovetail with previous research that has linked food and LHT in evidencing a relationship between obesity and a preference for calorie dense and filling foods in conditions of environmental harshness, as well as over-purchasing in high income families (Bentall et al., 2021; Dittman & Maner, 2017; Laran & Salereno, 2013). Choosing to purchase additional food might also indicate a more fluid response to environmental conditions as it less consequential than having a baby and therefore requires less thought, which potentially explains the difference in findings. Furthermore, if slow LHS/POLS individuals engage in future planning then it is congruent that increased uncertainty about the environment will elicit increased future proofing behaviour, which is also reflected in that they also reported increased COVID-19 concern in the first instance. These findings are interesting because they suggest that potentially, those

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with a slower LHS/POLS are more sensitive to detrimental changes to environmental conditions. That is, there may be a ceiling effect for those with a fast LHS/POLS in that their LHS does not accelerate any further when faced with further uncertainty. As such, it would be useful to examine whether and how individuals respond to conditions of increasing stability with respect to their LHS/POLS.

There are a number of limitations with the current study. Perhaps most notably, a longitudinal design would have been more effective in ascertaining behavioural change in response to changes in the environment. There is also ongoing debate about whether it is possible to psychometrically measure LHS (c.f., Manson & Kruger, 2022, Richardson et al., 2021) as well as the application of LHT to interindividual variation in human beings (Zietsch & Sidari, 2020) and therefore it is necessary to consider these current findings in the spirit of exploration and proof of concept. We have attempted to address some of these issues with respect to the inclusion of POLS rather than only LHS. Nevertheless, studies do produce consistent evidence in support of some of the tenets of LHT (e.g., Webster et al., 2014) and it provides an effective and valuable framework for understanding behavioural change in response to existential threat. Such understanding might be useful in developing and implementing effective interventions in similar situations as the panic buying of food and provisions are consistently evidenced as responses to pandemics and other resource sensitive situations (O'Connell et al., 2020, Sim et al., 2020).

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