Supplementary Information for:
Accelerated reproduction is not an adaptive response to early-life adversity in wild baboons

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**Supplementary Information Text**

**Methods**

**Measuring early-life adversity**

We measured the same six sources of early-life adversity used in Tung *et al.* (1). The data underlying these measures were collected as follows.

*Maternal death.* Maternal death occurred if the focal female’s mother died before the focal female reached 4 years of age. Four years represents the earliest age when females attain menarche and become sexually mature (2).

*Presence of a competing younger sibling.* The presence of a competing younger sibling occurred if the focal female’s mother gave birth to another live offspring before the focal female reached 1.5 years of age, which represents the lower quartile of surviving interbirth intervals in this population.

*Drought.* Drought occurred if the total rainfall during the focal female’s first year of life did not exceed 200 mm (median annual rainfall is 344 mm). Rainfall is measured daily at the field site using a rain gauge.

*Maternal social isolation.* We calculated maternal social isolation by determining the relative social connectedness of a focal female’s mother to other adult females during the first two years of the focal female’s life. Social connectedness measures were based on a metric of social connectedness (SCI-F) used in previous studies in this population (1, 3). SCI-F measures the mother’s frequency of grooming interactions (both as the actor or recipient) with other adult females in the social group in the same year and is then normalized relative to these rates for all other females alive in the population during the same year. The value was standardized and adjusted for observer effort (1, 3). To transform this measure of social connectedness into a measure of social isolation, we multiplied these values by -1. For the final maternal social isolation variable, negative measures thus represented females with relatively high frequencies of grooming during the designated time period, while positive measures represented females with relatively low frequencies of grooming (i.e. females with socially isolated mothers).

*Maternal dominance rank.* Maternal dominance rank was defined as the ordinal dominance rank of the female’s mother during the month that the focal female was born. Dominance ranks in Amboseli are determined based on the observed outcomes of dyadic aggressive interactions, on a monthly basis (4). Win and loss records are compiled into a pairwise interaction matrix and rank orderings are then assigned to
minimize the number of interactions in which lower ranking females won interactions with higher ranking females (1, 5).

Social density. Social density was determined based on the total number of adult social group members in the focal female’s social group on the day of her birth. Membership in a social group is determined via census data that are collected during regular field observations. Individuals are considered adults if the females have attained menarche and the males have enlarged testes.

Measuring pace of reproduction and lifespan

Calculating age at first live birth. Age at first birth was defined as the focal female’s age when she gave birth to her first live offspring. For the majority of individuals in the data set, the subject’s birthdate and the date when she gave birth to her first live offspring are known to within a few days (birthdate=91.4%, N=255; date of first birth=90.3%, N=252); for the rest of the individuals, the dates are accurate within three months (birthdate=8.6%, N=24; date of first birth=9.7%, N=27).

Calculating lifespan. For all lifespan measurements, individuals’ birthdates and death dates are known within a few days. In our survival models, we also included censored individuals—individuals who are either still alive or for whom we stopped following while they were still living. For these individuals (N=132; 57.4%), birthdates and censored dates are also known to within a few days.
Fig. S1. Cumulative early-life adversity predicted lifespan in female baboons. Survival curves show that the number of experienced sources of early-life adversity predicted adult lifespan. Lifespan was significantly reduced for individuals who experienced more sources of adversity ($r^2=0.052$, Wald Test $P=4.67 \times 10^{-4}$, $N=230$). Colors indicate the number of adverse conditions occurring in early life.
Fig. S2. Individual sources of early-life adversity did not predict the timing or pace of reproduction in female baboons. Plots depict the relationship between all pairwise combinations of the three individual sources of early-life adversity that predict survival (maternal death [row A]; competing sibling [row B]; maternal social isolation [row C]), and the three measures of reproductive pace (age at first birth [left column]; interbirth interval [middle column]; combined reproductive pace [right column]). None of the sources of early-life adversity significantly predicted any of the pace of reproduction measures. Data points in plots A and B are jittered along the x-axis to increase readability.
Fig. S3. Accelerated combined reproductive pace offered fitness benefits, but only for individuals who experienced little early-life adversity. (A) Predicted relationships between cumulative adversity, pace of reproduction, and lifetime reproductive success (LRS) under the iPAR model. (B) The observed relationships between cumulative adversity, combined reproductive pace, and LRS in this study. The points in B represent the raw data and are colored and shaped based on whether the combined reproductive pace was above (accelerated=blue circles) or below (delayed=purple triangles) the median value. The lines represent the predicted values from the linear model that best fit the data, holding combined reproductive pace at the bottom 25th percentile (delayed=purple dashed) or the top 25th percentile (accelerated=blue solid). The model with the interaction was nearly a better fit for the data compared to the model without the interaction, based on our model selection criterion ($\Delta$AIC=1.999; $N$=32); however, the interaction was in the opposite direction of the iPAR’s prediction (plot A). Specifically, plot B shows that accelerated reproduction predicted greater LRS for individuals who did not experience early-life adversity, but not for females who did experience early-life adversity. Data points in plot B are jittered along the x-axis to increase readability.
Fig. S4. Short interbirth intervals predicted shorter lifespans for individuals who experienced maternal death. Survival curves showing the interaction effect between maternal death and average interbirth interval ($P_{interaction}=0.035$; $P_{IBI}=0.014$; $P_{maternal death}=0.034$; N=110). Colors represent exposure to maternal death in the first four years of life (blue=no maternal death; red=maternal death) and line types represent average length of interbirth intervals (solid=shorter than the median; dashed=longer than the median). The pattern reveals that individuals who experienced maternal death led shorter lives if they accelerated their reproduction as adults.
Table S1. Sample sizes for all statistical analyses. Analyses focus on the four measures of early-life adversity that most strongly predict lifespan (see Results).

| Analysis                                                                 | Maternal death | Competing sibling | Maternal social isolation | Cumulative adversity |
|-------------------------------------------------------------------------|----------------|-------------------|---------------------------|----------------------|
| Nettle & Bateson’s 1st prediction: Does early adversity predict survival? |                |                   |                           | 230 females          |
| Initial analysis 1: Does accelerated pace of reproduction increase fitness? | Age at first birth & average IBI |                   |                           | 110 females          |
|                                                                         | Combined reproductive pace |                   |                           | 81 females           |
| Initial analysis 2: Does early-life adversity predict accelerated pace of reproduction? | Age at first birth | 279 females       | 279 females               | 211 females          |
|                                                                         | IBI              | 643 intervals in 189 females | 643 intervals in 189 females | 452 intervals in 138 females |
|                                                                         | Combined reproductive pace | 80 females       | 80 females                | 32 females           |
| Nettle & Bateson’s 2nd prediction: Does accelerated pace of reproduction predict increased fitness specifically for females who experienced early-life adversity? | Age at first birth | 145 females       | 145 females               | 85 females           |
|                                                                         | Average IBI      | 110 females       | 110 females               | 61 females           |
|                                                                         | Combined reproductive pace | 81 females       | 81 females                | 32 females           |
| Nettle & Bateson’s 3rd prediction: Does accelerated pace of reproduction predict increased fitness specifically for females with short lifespan? | Age at first birth |                   |                           | 145 females          |
|                                                                         | Average IBI      |                   |                           | 110 females          |
|                                                                         | Combined reproductive pace |                   |                           | 81 females           |
Table S2. Results of a multivariate Cox proportional hazards model testing the relationship between each source of early-life adversity and lifespan in female baboons (whole model \( r^2 = 0.08, P = 2.36 \times 10^{-3}, N = 230 \)). Maternal death, maternal social isolation, and competing sibling were the strongest predictors of lifespan in this population.

| Source of early-life adversity | Coefficient | Hazard ratio (± 95% CI) | P    | Interpretation                              |
|--------------------------------|-------------|-------------------------|------|---------------------------------------------|
| Maternal rank                 | 0.024       | 1.024 (0.980 – 1.070)   | 0.288|                                             |
| Competing sibling             | 0.532       | 1.702 (0.968 – 2.994)   | 0.065| Competing younger sibling predicts earlier mortality |
| Maternal social isolation     | 0.378       | 1.459 (1.042 – 2.043)   | 0.028| Maternal social isolation predicts earlier mortality |
| Rainfall                      | 0.081       | 1.084 (0.603 – 1.948)   | 0.787|                                             |
| Maternal death                | 0.866       | 2.377 (1.507 – 3.748)   | 1.96 \times 10^{-4} | Maternal death predicts earlier mortality |
| Social density                | -0.005      | 0.995 (0.968 – 1.023)   | 0.720|                                             |
Table S3. Effects of lifespan and pace of reproduction on female lifetime reproductive success (LRS), where LRS is defined as the total number of offspring born to each female that survived to 70 weeks†.

| Predictor variable* | Coefficient | SE     | z      | P        | % variance explained |
|---------------------|-------------|--------|--------|----------|----------------------|
| Model 1: Do lifespan, age at first birth, and average IBI predict LRS? |             |        |        |          |                      |
| Lifespan            | 0.407       | 0.021  | 19.518 | 7.00 x 10^{-37} | 71.8%               |
| Age at first birth  | -0.608      | 0.174  | -3.503 | 6.74 x 10^{-4}  | 6.7%                |
| Average IBI         | -3.043      | 0.700  | -4.347 | 3.18 x 10^{-5}  | 3.3%                |
| Model 2: Do lifespan and combined reproductive pace predict LRS? |             |        |        |          |                      |
| Lifespan            | 0.422       | 0.025  | 16.591 | 2.65 x 10^{-27} | 70.5%               |
| Combined reproductive pace | -0.884  | 0.154  | -5.755 | 1.63 x 10^{-7}  | `8.8%               |

† Results using the original definition of lifetime reproductive success (the total number of live offspring born to each female) are found in Table 2 in the main text.
* Lifespan and age at first birth are measured in years, while average interbirth interval (IBI) is the natural log transformed length of the mean IBI measured in days.
Table S4. The effects of early-life adversity on pace of reproduction. For initial analysis 2, we used multivariate linear models to test all pairwise combinations of different measures of early-life adversity and different measures of reproductive acceleration. Our measures of early adversity included cumulative adversity (all adverse events combined), maternal death, competing sibling, and maternal social isolation; our measures of reproductive acceleration included age at first birth, surviving interbirth intervals, and combined reproductive pace. Covariates include social/environmental factors shown in prior studies to explain variation in female reproduction in our population (6, 7). None of the sources of early-life adversity significantly predicted female reproductive timing or pace (p-values > 0.05).

| Predictor variables | Coefficient | SE   | P      | Interpretation                                      |
|---------------------|-------------|------|--------|-----------------------------------------------------|
| **Effects of cumulative adversity** |             |      |        |                                                     |
| Response variable: Age at first birth (N = 211 females) | Cumulative early adversity | 0.021 | 0.047 | 0.66 | Cumulative adversity does not predict age at first birth |
| Group size at first birth | -0.003 | 0.007 | 0.67 | Group size does not predict age at first birth |
| **Response variable: Interbirth interval (IBI) (N = 452 intervals in 138 females)** | Cumulative early adversity | 0.006 | 0.014 | 0.69 | Cumulative adversity does not predict IBI duration |
| Rank at the start of the IBI | 0.009 | 0.002 | <0.001 | Low ranking females have longer IBIs |
| Parity at the start of the IBI | 0.024 | 0.032 | 0.46 | Parity does not predict IBI duration |
| Age at the start of the IBI | -0.063 | 0.019 | <0.001 | Middle-aged females have shorter IBIs |
| Age² at the start of the IBI | 0.003 | 0.001 | <0.001 |                                             |
| **Response variable: Combined reproductive pace (CRP) (N = 32 females)** | Cumulative early adversity | -0.046 | 0.133 | 0.73 | Cumulative adversity does not predict CRP |
| Group size at first birth | -0.014 | 0.017 | 0.39 | Group size does not predict CRP |
| Average rank at the start of the IBIs | 0.089 | 0.022 | <0.001 | Low ranking females have slower CRP |
| **Effects of maternal death** |             |      |        |                                                     |
| Response variable: Age at first birth (N = 279 females) | Maternal death | -0.020 | 0.087 | 0.82 | Maternal death does not predict age at first birth |
| Group size at first birth | 0.001 | 0.006 | 0.90 | Group size does not predict age at first birth |
| **Response variable: Interbirth interval (N = 643 intervals in 189 females)** | Maternal death | -0.010 | 0.025 | 0.69 | Maternal death does not predict IBI duration |
| Rank at the start of the IBI | 0.009 | 0.002 | <0.001 | Low ranking females have longer IBIs |
| Parity at the start of the IBI | 0.038 | 0.027 | 0.16 | Parity does not predict IBI duration |
| Age at the start of the IBI | -0.045 | 0.015 | 0.003 | Middle-aged females have shorter IBIs |
| Age² at the start of the IBI | 0.002 | 0.001 | 0.002 |                                             |
| **Response variable: Combined reproductive pace (N = 80 females)** | Maternal death | 0.055 | 0.160 | 0.73 | Maternal death does not predict CRP |
| Group size at first birth | 0.009 | 0.015 | 0.55 | Group size does not predict CRP |
|--------------------------|-------|-------|------|---------------------------------|
| Average rank at the start of the IBIs | 0.089 | 0.016 | <0.001 | Low ranking females have slower CRP |

**Effects of competing sibling**

| Response variable: Age at first birth (N = 279 females) |
|---------------------------------------------------------|
| Competing sibling | -0.074 | 0.091 | 0.42 | The presence of a competing sibling does not predict age at first birth |
| Group size at first birth | 0.001 | 0.006 | 0.82 | Group size does not predict age at first birth |

| Response variable: Interbirth interval (N = 643 intervals in 189 females) |
|----------------------------------------------------------------------------|
| Competing sibling | -0.041 | 0.026 | 0.11 | The presence of a competing sibling does not predict IBI duration |
| Rank at the start of the IBI | 0.009 | 0.002 | <0.001 | Low ranking females have longer IBIs |
| Parity at the start of the IBI | 0.037 | 0.027 | 0.17 | Parity does not predict IBI duration |
| Age at the start of the IBI | -0.046 | 0.015 | 0.002 | Middle-aged females have shorter IBIs |
| Age² at the start of the IBI | 0.002 | 0.001 | 0.002 | |

| Response variable: Combined reproductive pace (N = 80 females) |
|---------------------------------------------------------------|
| Competing sibling | -0.373 | 0.206 | 0.07 | The presence of a competing sibling does not predict CRP |
| Group size at first birth | 0.013 | 0.016 | 0.41 | Group size does not predict CRP |
| Average rank at the start of the IBIs | 0.078 | 0.016 | <0.001 | Low ranking females have slower CRP |

**Effects of maternal social isolation**

| Response variable: Age at first birth (N = 211 females) |
|--------------------------------------------------------|
| Maternal social isolation | -0.020 | 0.064 | 0.75 | Maternal social isolation does not predict age at first birth |
| Group size at first birth | -0.003 | 0.007 | 0.66 | Group size does not predict age at first birth |

| Response variable: Interbirth interval (N = 452 intervals in 138 females) |
|--------------------------------------------------------------------------|
| Maternal social isolation | -0.014 | 0.020 | 0.51 | Maternal social isolation does not predict IBI duration |
| Rank at the start of the IBI | 0.009 | 0.002 | <0.001 | Low ranking females have longer IBIs |
| Parity at the start of the IBI | 0.024 | 0.032 | 0.46 | Parity does not predict IBI duration |
| Age at the start of the IBI | -0.063 | 0.019 | <0.001 | Middle-aged females have shorter IBIs |
| Age² at the start of the IBI | 0.003 | 0.001 | <0.001 | |

| Response variable: Combined reproductive pace (N = 32 females) |
|--------------------------------------------------------------|
| Maternal social isolation | -0.285 | 0.195 | 0.14 | Maternal social isolation does not predict CRP |
| Group size at first birth | -0.017 | 0.016 | 0.30 | Group size does not predict CRP |
| Average rank at the start of the IBIs | 0.083 | 0.022 | <0.001 | Low ranking females have slower CRP |
Table S5. Testing Nettle and Bateson’s 2nd prediction (8): interaction effects between early-life adversity and pace of reproduction predicting lifetime reproductive success, defined as the total number of live offspring born to each female. Results using the alternative definition of lifetime reproductive success, which includes offspring survival to weaning, are found in Table S6. We tested for an interaction effect between all pairwise combinations of early-life adversity (cumulative early-life adversity, maternal death, competing sibling, and maternal social isolation) and all three measures of reproductive acceleration (age at first birth, surviving interbirth intervals, and combined reproductive pace). For each early-life adversity and pace of reproduction combination, the best-fitting model for predicting lifetime reproductive success was determined via a difference in Akaike information criteria (AIC) greater than 2; if the difference in AICs was less than 2, we chose the simpler model (the model without the interaction effect). ΔAIC values greater than 2 represent comparisons where the model with the interaction was a better fit for the data. The asterisk (*) marks a model where the interaction was a better fit for the data. For all of the adversity and pace of reproduction pairings, the model with the interaction was only a better fit under one condition: maternal death and combined reproductive pace. However, this interaction was in the opposite direction of the iPAR’s prediction.

| Predictor variable | Coefficient | SE   | P       | ΔAIC (ΔAIC > 2 supports the presence of an interaction effect) | Interpretation |
|-------------------|-------------|------|---------|----------------------------------------------------------------|----------------|
| **Adversity metric: Cumulative adversity** | | | | |
| **Pace of reproduction metric: Age at first birth (N = 85 females)** | | | | |
| Interaction Age at first birth | -1.888 | 0.861 | 0.031 | -1.318 | The interaction effect does not significantly improve model fit |
| Cumulative adversity | -4.084 | 3.475 | 0.243 | | |
| Interaction | 0.453 | 0.560 | 0.422 | | |
| No interaction Age at first birth | -1.310 | 0.478 | 0.008 | | |
| Cumulative adversity | -1.293 | 0.371 | 0.001 | | |
| **Pace of reproduction metric: Interbirth interval (N = 61 females)** | | | | |
| Interaction Interbirth interval | -6.598 | 4.309 | 0.131 | -1.976 | The interaction effect does not significantly improve model fit |
| Cumulative adversity | -3.533 | 18.048 | 0.846 | | |
| Interaction | 0.418 | 2.769 | 0.881 | | |
| No interaction Interbirth interval | -6.020 | 1.953 | 0.003 | | |
| Cumulative adversity | -0.811 | 0.414 | 0.055 | | |
| **Pace of reproduction metric: Combined reproductive pace (N = 32 females)** | | | | |
| Interaction Combined reproductive pace | -3.260 | 1.568 | 0.047 | 1.999 | The interaction effect does not significantly improve model fit |
| Cumulative adversity | -0.433 | 0.612 | 0.485 | | |
| Interaction | 1.780 | 0.922 | 0.064 | | |
### Adversity metric: Maternal death

#### Pace of reproduction metric: Age at first birth (N = 145 females)

| Interaction     | Age at first birth | Maternal death | Interaction | p-value |
|-----------------|--------------------|----------------|-------------|---------|
| Interaction     | -1.597             | 0.468          | 0.153       |         |
| Maternal death  | -7.761             | 4.895          | 0.001       |         |
| Interaction     | 1.147              | 0.789          | 0.149       |         |
| No interaction  | -1.194             | 0.378          | 0.223       |         |
| Maternal death  | -0.701             | 0.572          |             |         |

The interaction effect does not significantly improve model fit.

### Pace of reproduction metric: Interbirth interval (N = 110 females)

| Interaction     | Interbirth interval | Maternal death | Interaction | p-value |
|-----------------|---------------------|----------------|-------------|---------|
| Interaction     | -8.364              | 1.875          | <0.001      |         |
| Maternal death  | -42.391             | 21.401         | 0.054       |         |
| Interaction     | 6.408               | 3.289          |             |         |
| No interaction  | -6.282              | 1.560          | <0.001      |         |
| Maternal death  | -0.713              | 0.583          | 0.224       |         |

The interaction effect does not significantly improve model fit.

### Pace of reproduction metric: Combined reproductive pace (N = 81 females)

| Interaction     | Combined reproductive pace | Maternal death | Interaction | p-value |
|-----------------|-----------------------------|----------------|-------------|---------|
| Interaction     | -1.598                      | 0.489          | 0.002       | 4.001*  |
| Maternal death  | -0.762                      | 0.696          | 0.277       |         |
| Interaction     | 1.794                       | 0.737          | 0.017       |         |
| No interaction  | -0.810                      | 0.377          | 0.035       |         |
| Maternal death  | -0.634                      | 0.716          | 0.379       |         |

The interaction effect significantly improves the model, but the interaction is in the direction opposite to the iPAR’s prediction; females who do not experience maternal death and accelerate their reproduction accrue fitness benefits.

### Adversity metric: Competing sibling

#### Pace of reproduction metric: Age at first birth (N = 145 females)

| Interaction     | Age at first birth | Competing sibling | Interaction | p-value |
|-----------------|--------------------|-------------------|-------------|---------|
| Competing sibling | 0.389             | 5.877             | 0.947       | -1.881  |
| Interaction     | -0.330             | 0.968             | 0.734       |         |
| No interaction  | -1.301             | 0.375             | 0.001       |         |
| Competing sibling | -1.599             | 0.650             | 0.015       |         |

The interaction effect does not significantly improve model fit.

### Pace of reproduction metric: Interbirth interval (N = 110 females)

| Interaction     | Interbirth interval | Competing sibling | p-value |
|-----------------|---------------------|-------------------|---------|
| Competing sibling | -6.617             | 1.776             | <0.001  |
| No interaction  | -1.779              | 10.202            | 25.377  | 0.688   |

The interaction effect does not significantly
| Interaction          | Combined reproductive pace | Competing sibling | Interaction | Combined reproductive pace | Competing sibling |
|----------------------|-----------------------------|-------------------|-------------|-----------------------------|-------------------|
| No interaction       | -1.819                      | 3.939             | 0.645       | -6.987                      | 1.580             | <0.001 |
|                      |                             |                   |             |                             |                   |        |
|                      |                             |                   |             |                             |                   |        |
| **Pace of reproduction metric: Combined reproductive pace (N = 81 females)** |
| Interaction          | -0.868                      | 1.245             | 0.488       | -1.490                      |                   |        |
| No interaction       | -1.110                      | 0.426             | 0.011       |                             |                   |        |
|                      |                             |                   |             |                             |                   |        |
|                      |                             |                   |             |                             |                   |        |
|                      |                             |                   |             |                             |                   |        |
| **Adversity metric: Maternal social isolation** |
| **Pace of reproduction metric: Age at first birth (N = 85 females)** |
| Interaction          | -1.405                      | 0.542             | 0.011       | -1.155                      |                   |        |
| Maternal isolation   | 4.920                       | 6.094             | 0.422       |                             |                   |        |
| Interaction          | -0.873                      | 0.970             | 0.371       |                             |                   |        |
| No interaction       | -1.273                      | 0.521             | 0.017       |                             |                   |        |
| Maternal isolation   | -0.537                      | 0.598             | 0.372       |                             |                   |        |
| **Pace of reproduction metric: Interbirth interval (N = 61 females)** |
| Interaction          | -7.630                      | 2.162             | <0.001      | 0.488                       |                   |        |
| Maternal isolation   | 45.700                      | 29.548            | 0.127       |                             |                   |        |
| Interaction          | -6.988                      | 4.536             | 0.129       |                             |                   |        |
| No interaction       | -6.312                      | 2.008             | 0.003       |                             |                   |        |
| Maternal isolation   | 0.194                       | 0.638             | 0.762       |                             |                   |        |
| **Pace of reproduction metric: Combined reproductive pace (N = 32 females)** |
| Interaction          | -0.869                      | 0.716             | 0.235       | 0.809                       |                   |        |
| Maternal isolation   | -1.066                      | 0.990             | 0.290       |                             |                   |        |
| Interaction          | -2.836                      | 1.770             | 0.120       |                             |                   |        |
| No interaction       | -0.568                      | 0.709             | 0.429       |                             |                   |        |
| Maternal isolation   | -0.575                      | 0.966             | 0.556       |                             |                   |        |

The interaction effect does not significantly improve model fit.
Table S6. Testing Nettle and Bateson’s 2nd prediction (8): interaction effects between early-life adversity and pace of reproduction predicting lifetime reproductive success, defined as the total number of offspring born to each female that survived to 70 weeks. Results using the original definition of lifetime reproductive success, which does not consider offspring survival, are found in Table S5. We tested for an interaction effect between all pairwise combinations of early-life adversity (cumulative early-life adversity, maternal death, competing sibling, and maternal social isolation) and all three measures of reproductive acceleration (age at first birth, surviving interbirth intervals, and combined reproductive pace). For each early-life adversity and pace of reproduction combination, the best-fitting model for predicting lifetime reproductive success was determined via a difference in Akaike information criteria (AIC) greater than 2; if the difference in AICs was less than 2, we chose the simpler model (the model without the interaction effect). ΔAIC values greater than 2 represent comparisons where the model with the interaction was a better fit for the data. The asterisk (*) marks a model where the interaction was a better fit for the data. For all of the adversity and pace of reproduction pairings, the model with the interaction was only a better fit under two conditions: maternal death and interbirth intervals, and maternal death and combined reproductive pace. However, these interactions were in the opposite direction of the iPAR’s prediction.

| Model        | Predictor variable | Coefficient | SE   | P      | ΔAIC (>2 supports the presence of an interaction effect) | Interpretation                                      |
|--------------|--------------------|-------------|------|--------|------------------------------------------------------|-----------------------------------------------------|
| **Adversity metric: Cumulative adversity** |                  |             |      |        |                                                      |                                                     |
| Pace of reproduction metric: Age at first birth (N = 85 females) |                  |             |      |        |                                                      |                                                     |
| Interaction  | Age at first birth | -1.729      | 0.736| 0.021  | -1.314                                              | The interaction effect does not significantly improve model fit |
|              | Cumulative adversity | -3.642      | 2.971| 0.224  |                                                      |                                                     |
|              | Interaction        | 0.388       | 0.479| 0.421  |                                                      |                                                     |
| No interaction | Age at first birth | -1.233      | 0.409| 0.003  |                                                      |                                                     |
|              | Cumulative adversity | -1.249      | 0.317| <0.001 |                                                      |                                                     |
| **Pace of reproduction metric: Interbirth interval (N = 61 females)** |                  |             |      |        |                                                      |                                                     |
| Interaction  | Interbirth interval | -10.792     | 3.647| 0.004  | 0.227                                               | The interaction effect does not significantly improve model fit |
|              | Cumulative adversity | -23.032     | 15.275| 0.137  |                                                      |                                                     |
|              | Interaction        | 3.411       | 2.343| 0.151  |                                                      |                                                     |
| No interaction | Interbirth interval | -6.070      | 1.683| <0.001 |                                                      |                                                     |
|              | Cumulative adversity | -0.801      | 0.357| 0.029  |                                                      |                                                     |
| **Pace of reproduction metric: Combined reproductive pace (N = 32 females)** |                  |             |      |        |                                                      |                                                     |
| Interaction  | Combined reproductive pace | -2.638      | 1.436| 0.077  | 1.390                                               | The interaction effect does not significantly improve model fit |
|              | Cumulative adversity | -0.937      | 0.560| 0.106  |                                                      |                                                     |
|              | Interaction        | 1.495       | 0.845| 0.088  |                                                      |                                                     |
| No interaction | Combined reproductive pace | -0.315      | 0.603| 0.605  |                                                      |                                                     |
### Adversity metric: Maternal death

| Pace of reproduction metric: Age at first birth (N = 145 females) | Interaction | Age at first birth | Maternal death | Interaction | Maternal death | Interaction |
|---------------------------------------------------------------|-------------|--------------------|----------------|-------------|----------------|-------------|
|                                                              |             | -1.567            | 0.387          | <0.001      | -7.994         | 4.043       |
|                                                              |             | 1.149             | 0.652          | 0.080       | 0.038          | 0.038       |
| The interaction effect does not significantly improve model fit |             | 1.160             |                |             |                |             |

### Pace of reproduction metric: Interbirth interval (N = 110 females)

| Interaction | Interbirth interval | Maternal death | Interaction |
|-------------|---------------------|----------------|-------------|
|             | -8.183              | 1.532          | <0.001      |
|             | -51.064             | 17.491         | 0.004       |
|             | 7.699               | 2.688          | 0.005       |
| The interaction effect significantly improves the model, but the interaction is in the direction opposite to the iPAR’s prediction; females who do not experience maternal death and have short IBIs accrue fitness benefits | 6.198* |

### Pace of reproduction metric: Combined reproductive pace (N = 81 females)

| Interaction | Combined reproductive pace | Maternal death | Interaction |
|-------------|----------------------------|----------------|-------------|
|             | -1.253                     | 0.422          | 0.004       |
|             | -1.287                     | 0.601          | 0.035       |
|             | 1.414                      | 0.637          | 0.029       |
| The interaction effect significantly improves the model, but the interaction is in the direction opposite to the iPAR’s prediction; females who do not experience maternal death and accelerate their reproduction accrue fitness benefits | 3.031* |

### Adversity metric: Competing sibling

| Pace of reproduction metric: Age at first birth (N = 145 females) | Interaction | Age at first birth | Competing sibling | Interaction |
|-----------------------------------------------------------------|-------------|--------------------|-------------------|-------------|
|                                                                |             | -1.307             | 0.341             | <0.001      |
|                                                                |             | -2.485             | 4.815             | 0.607       |
|                                                                |             | 0.106              | 0.793             | 0.894       |
| The interaction effect does not significantly improve model fit | -1.982      |

### Pace of reproduction metric: Interbirth interval (N = 110 females)

| Interaction | Interbirth interval | Competing sibling | Interaction |
|-------------|---------------------|-------------------|-------------|
|             | -7.329              | 1.454             | <0.001      |
|             | -26.301             | 20.775            | 0.208       |
|             | 3.791               | 3.224             | 0.242       |
| The interaction effect does not significantly improve model fit | -0.575      |
| Interaction          | No interaction | Combined reproductive pace | Competing sibling | Interaction   | Combined reproductive pace | Competing sibling | Interaction   | P value   |
|---------------------|----------------|----------------------------|-------------------|---------------|----------------------------|-------------------|---------------|-----------|
|                     | Interbirth interval | -6.558 | 1.300 | <0.001 |                     | -1.887 | 0.598 | 0.002 |
|                     | Competing sibling   | -0.872 | 0.982 | 0.378 |
|                     | Interaction         | 1.651  | 1.039 | 0.116 |
| Pace of reproduction metric: Combined reproductive pace (N = 81 females) | | | | | | | | |
|                     | No interaction | Combined reproductive pace | -1.050 | 0.337 | 0.003 |
|                     | Competing sibling   | -1.892 | 0.751 | 0.138 |
|                     | Interaction         | 1.651  | 1.039 | 0.116 |
| Adversity metric: Maternal social isolation |
|                     | No interaction | Combined reproductive pace | -1.205 | 0.474 | 0.013 |
|                     | Maternal isolation | -0.064 | 5.325 | 0.990 |
|                     | Interaction         | -0.070 | 0.848 | 0.934 |
| Pace of reproduction metric: Age at first birth (N = 85 females) | | | | | | | | |
|                     | No interaction | Combined reproductive pace | -1.194 | 0.453 | 0.010 |
|                     | Maternal isolation | -0.509 | 0.520 | 0.335 |
|                     | Interaction         | -1.194 | 0.453 | 0.010 |
| Pace of reproduction metric: Interbirth interval (N = 61 females) | | | | | | | | |
|                     | No interaction | Combined reproductive pace | -7.189 | 1.899 | <0.001 |
|                     | Maternal isolation | 28.785 | 25.965 | 0.272 |
|                     | Interaction         | -4.394 | 3.986 | 0.275 |
| Pace of reproduction metric: Combined reproductive pace (N = 32 females) | | | | | | | | |
|                     | No interaction | Combined reproductive pace | -0.580 | 0.698 | 0.413 |
|                     | Maternal isolation | -1.065 | 0.964 | 0.279 |
|                     | Interaction         | -1.638 | 1.725 | 0.350 |
|                     | No interaction | Combined reproductive pace | -0.407 | 0.672 | 0.550 |
|                     | Maternal isolation | -0.781 | 0.915 | 0.400 |

The interaction effect does not significantly improve model fit.

The interaction effect does not significantly improve model fit.

The interaction effect does not significantly improve model fit.
Table S7. Model results for the three Cox proportional hazards models that include maternal death, the three pace of reproduction metrics, and their interactions as predictors of lifespan. The only significant interaction effect was between interbirth interval and maternal death. The direction of the interaction suggests that accelerating reproduction was costly (i.e. lead to shorter lifespans) for individuals who experienced maternal death.

| Predictor variable | Coefficient | Hazard ratio (± 95% CI) | P   | N  (# events) | Interpretation |
|--------------------|-------------|-------------------------|-----|---------------|----------------|
| Pace of reproduction metric: Age at first birth | | | | | |
| Age at first birth | 0.136 | 1.146 (0.848 – 1.547) | 0.375 | 280 (145) | The interaction effect is not significant |
| Maternal death | 1.189 | 3.285 (0.106 – 102.143) | 0.498 | | |
| Interaction | -0.129 | 0.879 (0.505 – 1.531) | 0.650 | | |
| Pace of reproduction metric: Interbirth interval | | | | | |
| Interbirth interval | 1.995 | 7.356 (1.487 – 36.380) | 0.014 | 110 (110) | The interaction effect is significant; individuals who lose their mother and have short IBIs live shorter lives |
| Maternal death | 20.300 | 6.551 x 10^4 (4.544 – 9.445 x 10^16) | 0.034 | | |
| Interaction | -3.113 | 0.044 (0.002 – 0.801) | 0.035 | | |
| Pace of reproduction metric: Combined reproductive pace | | | | | |
| Combined reproductive pace | 0.177 | 1.193 (0.816 – 1.745) | 0.362 | 81 (81) | The interaction effect is not significant |
| Maternal death | 0.092 | 1.097 (0.644 – 1.868) | 0.735 | | |
| Interaction | -0.619 | 0.539 (0.260 – 1.115) | 0.096 | | |
Testing Nettle and Bateson’s 3rd prediction (8): interaction effects between lifespan and pace of reproduction predicting lifetime reproductive success, defined as the total number of live offspring born to each female. Results using the alternative definition of lifetime reproductive success, which includes offspring survival to weaning, are found in Table S9. For each early-life adversity and pace of reproduction combination, the best-fitting model for predicting lifetime reproductive success was determined via a difference in Akaike information criteria (AIC) greater than 2; if the difference in AICs was less than 2, we chose the simpler model (the model without the interaction effect). ΔAIC values greater than 2 represent comparisons where the model with the interaction was a better fit for the data (represented with an asterisk (*)). For each pace of reproduction measure, the model with the interaction was a better fit for the data; however, the interaction was in the incorrect direction. For all of these circumstances, individuals who accelerated their reproduction only accrued greater lifetime reproductive success if they led long lives.

### Table S8

**Testing Nettle and Bateson’s 3rd prediction:** Interaction effects between lifespan and pace of reproduction predicting lifetime reproductive success, defined as the total number of live offspring born to each female. Results using the alternative definition of lifetime reproductive success, which includes offspring survival to weaning, are found in Table S9. For each early-life adversity and pace of reproduction combination, the best-fitting model for predicting lifetime reproductive success was determined via a difference in Akaike information criteria (AIC) greater than 2; if the difference in AICs was less than 2, we chose the simpler model (the model without the interaction effect). ΔAIC values greater than 2 represent comparisons where the model with the interaction was a better fit for the data (represented with an asterisk (*)). For each pace of reproduction measure, the model with the interaction was a better fit for the data; however, the interaction was in the incorrect direction. For all of these circumstances, individuals who accelerated their reproduction only accrued greater lifetime reproductive success if they led long lives.

| Model | Response variable | Coefficient | SE | P   | ΔAIC (>2 supports the presence of an interaction effect) | Interpretation |
|-------|------------------|-------------|----|-----|------------------------------------------------------|----------------|
| **Pace of reproduction metric: Age at first birth (N = 145 females)** | | | | | | |
| Interaction | Age at first birth | -0.062 | 0.381 | 0.870 | | |
| | Lifespan | 0.910 | 0.153 | <0.001 | | |
| | Interaction | -0.062 | 0.025 | 0.015 | | |
| No interaction | Age at first birth | -0.955 | 0.114 | <0.001 | | |
| | Lifespan | 0.537 | 0.014 | <0.001 | | |
| **Pace of reproduction metric: Interbirth interval (N = 110 females)** | | | | | | |
| Interaction | Interbirth interval | 3.436 | 1.569 | 0.031 | 23.553* | The interaction effect significantly improves the model, but the interaction is in the direction opposite to the iPAR’s prediction; females who have short IBIs and live long lives accrue fitness benefits |
| | Lifespan | 4.027 | 0.668 | <0.001 | | |
| | Interaction | -0.542 | 0.103 | <0.001 | | |
| No interaction | Interbirth interval | -4.390 | 0.560 | <0.001 | | |
| | Lifespan | 0.514 | 0.019 | <0.001 | | |
| **Pace of reproduction metric: Combined reproductive pace (N = 81 females)** | | | | | | |
| Interaction | Combined reproductive pace | 0.746 | 0.408 | 0.071 | 17.381* | The interaction effect significantly improves the model, but the interaction is in the direction opposite to the iPAR’s prediction; females who have a fast combined reproductive pace and live long lives accrue fitness benefits |
| | Lifespan | 0.495 | 0.019 | <0.001 | | |
| | Interaction | -0.109 | 0.024 | <0.001 | | |
| No interaction | Combined reproductive pace | -1.043 | 0.126 | <0.001 | | |
| | Lifespan | 0.515 | 0.021 | <0.001 | | |
Table S9. Testing Nettle and Bateson’s 3rd prediction (8): interaction effects between lifespan and pace of reproduction predicting lifetime reproductive success, defined as the total number of offspring born to each female that survived to 70 weeks. Results using the original definition of lifetime reproductive success, which does not consider offspring survival, are found in Table S8. For each early-life adversity and pace of reproduction combination, the best-fitting model for predicting lifetime reproductive success was determined via a difference in Akaike information criteria (AIC) greater than 2; if the difference in AICs was less than 2, we chose the simpler model (the model without the interaction effect). ΔAIC values greater than 2 represent comparisons where the model with the interaction was a better fit for the data (represented with an asterisk (*)). For two of the pace of reproduction measures (interbirth intervals and combined reproductive pace), the model with the interaction was a better fit for the data; however, the interaction was in the incorrect direction. For these circumstances, individuals who accelerated their reproduction only accrued greater lifetime reproductive success if they led long lives.

| Model                      | Response variable | Coefficient | SE   | P       | ΔAIC (Δ>2 supports the presence of an interaction effect) | Interpretation                                                                 |
|----------------------------|-------------------|-------------|------|---------|----------------------------------------------------------|-------------------------------------------------------------------------------|
| **Pace of reproduction metric: Age at first birth (N = 145 females)** |                   |             |      |         |                                                         |                                                                               |
| Interaction                | Age at first birth | -0.213      | 0.428| 0.620   | 1.538                                                   | The interaction effect does not significantly improve model fit                |
|                            | Lifespan          | 0.750       | 0.172| <0.001  |                                                         |                                                                               |
|                            | Interaction       | -0.053      | 0.029| 0.064   |                                                         |                                                                               |
| No interaction             | Age at first birth | -0.977      | 0.128| <0.001  |                                                         |                                                                               |
|                            | Lifespan          | 0.431       | 0.016| <0.001  |                                                         |                                                                               |
| **Pace of reproduction metric: Interbirth interval (N = 110 females)** |                   |             |      |         |                                                         |                                                                               |
| Interaction                | Interbirth interval| 3.653      | 1.890| 0.056   | 16.250*                                                 | The interaction effect significantly improves the model, but the interaction is in the direction opposite to the iPAR’s prediction; females who have short IBIs and live long lives accrue fitness benefits |
|                            | Lifespan          | 3.921       | 0.804| <0.001  |                                                         |                                                                               |
|                            | Interaction       | -0.542      | 0.124| <0.001  |                                                         |                                                                               |
| No interaction             | Interbirth interval| -4.179     | 0.652| <0.001  |                                                         |                                                                               |
|                            | Lifespan          | 0.404       | 0.022| <0.001  |                                                         |                                                                               |
| **Pace of reproduction metric: Combined reproductive pace (N = 81 females)** |                   |             |      |         |                                                         |                                                                               |
| Interaction                | Combined reproductive pace | 0.667      | 0.529| 0.211   | 7.254*                                                  | The interaction effect significantly improves the model, but the interaction is in the direction opposite the iPAR’s prediction; females who have a fast combined reproductive pace and live long lives accrue fitness benefits |
|                            | Lifespan          | 0.405       | 0.025| <0.001  |                                                         |                                                                               |
|                            | Interaction       | -0.095      | 0.031| 0.003   |                                                         |                                                                               |
| No interaction             | Combined reproductive pace | -0.884      | 0.154| <0.001  |                                                         |                                                                               |
|                            | Lifespan          | 0.422       | 0.025| <0.001  |                                                         |                                                                               |
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