

Supplemental Materials

Evolutionary Psychological Science

Title: Associations Between Early Life Stress, Health Behaviors, and Risk-Taking in Adulthood: A Structural Equation Modeling Approach

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Data Preparation

The variable ‘misery delay discounting’ in the measurement model on adult health-behavior and risk-taking (Measurement Model C) is based on a total of six items and uses the area under the discounting curve (AUC) as the final value. AUC was preferred over the hyperbolic or exponential model as it does not rely on a specific delay discounting theory (Hardisty et al., 2011). ‘Misery delay discounting’ was measured by a total of six items which represented the six delay periods (i.e., right now, one month, one year, three years, 10 years, 30 years). Participants’ responses to each item represented the six indifference points, which were used to plot the function and calculate AUC using ordinal transformation (Borges et al., 2016).

For both delay discounting measures “monetary delay discounting” (not used in final model) and “misery delay discounting” (used in final model), delay periods increase pseudo-exponentially, which means that time intervals between delay periods become larger as delays become longer. If areas of trapezoids are simply summed up, trapezoids that represent large delay periods, e.g. 20 years, will have a disproportionate impact on total AUC compared to smaller delay periods, e.g. one month. To overcome this imbalance in relative contribution to the final AUC, an alternative method using ordinal transformation, AUC_{ord} , was used, standardizing the difference between indifference points to 1 (Borges et al., 2016).

Calculation of Final Value for Observed Variable “Misery Delay Discounting”

This observed variable is used in the final model (part of measurement model C).
Delay periods: 1 month, 1 year, 3 years, 10 years, 20 years

Following Borges et al. (2016) the distance between indifference points was standardized to 1 as follows:

Indifference points are equal to the participant's rating on a 1 to 5- Likert scale for each delay period T_1 - T_5 .

Set of indifference points $P=\{P_1, P_2, P_3, P_4, P_5, \}$ with $P_i \in \{1, 2, 3, 4, 5\}$, $i=1, \dots, 5$

Set of delay periods $T=\{T_1=1, T_2=2, T_3=3, T_4=4, T_5=5\}$

$$AUC_{ord} = \frac{1}{25-B} \left[\left(\sum_{i=1}^4 \frac{P_{i+1} + P_i}{2} (T_{i+1} - T_i) \right) - B \right]$$

where $B=1*(T_5-T_1)$

Calculation of Final Value for Observed Variable “Monetary Delay Discounting”

This observed variable was not used in the final model as results of EFA showed that it did not cluster together with other variables on adult health-and risk-related behaviors to reflect a common factor.

Delay periods: 1 week, 1 year, 25 years

Following Borges et al. (2016) the distance between indifference points was standardized to 1 as follows:

Set of indifference points $P=\{P_1, P_2, P_3\}$ with $P_i \in \{0.05, 0.1, 0.2, 0.4, 0.6, 0.8, 0.9, 1\}$

Indifference points are calculated as $\frac{SSR}{LLR}$ taking values of SSR (smaller, sooner reward) and LLR (larger, later reward) of the binary choice task when the participant first chooses the LLR. For example, if the participant chooses \$200 right now over \$1000 in one year from now, her indifference point P_2 for delay period T_2 is equal to 0.2, meaning the value of the LLR is discounted by 80%.

Set of delay periods $T=\{T_1=1, T_2=2, T_3=3\}$

$$AUC_{ord} = \frac{1}{2-B} \left[\left(\sum_{i=1}^2 \frac{P_{i+1} + P_i}{2} (T_{i+1} - T_i) \right) - B \right]$$

where $B=0.05*(T_3-T_1)$

Model Building Process and Intermediate Results

Measurement Model A Using Items on Early Life Stress

Exploratory Factor Analysis

Exploratory Factor Analysis (EFA) with WLSMV estimation was used to examine the factor structure of the set of 24 indicators related to early childhood experiences and to identify how well these items measure the latent constructs based on the six categories of Early Life Stress (ELS). EFA with Geomin rotation was performed for models with $m = 1$ to 7 (m refers to the number of extracted factors). When assessing magnitude of factor loadings, the main criterion was the size of a loading relative to those of other indicators (Costello & Osborne, 2005; Muthén & Muthén, 1998-2017). Applying rigid, absolute cut-off rules regardless of sample size and variable complexity can lead to model misspecification and is generally not advisable (Preacher et al., 2013; Yong & Pearce, 2013). In an iterative procedure, five indicators were excluded from the model one by one as they did not adequately measure any of the potential factors. Fit statistics for models with $m = 1$ to 7 were compared. Significant chi-square results indicated that the null-hypothesis of exact model fit in the population needed to be rejected for all candidate models. This test is, however, influenced by sample size and highly sensitive to even minor misspecification (Marsh et al., 2005). Widely used interpretation guidelines view Root Mean Square Error of Approximation (RMSEA) values smaller than 0.08 or 0.06 as indicating acceptable and excellent fit respectively, while values for the Confirmatory Fit Index (CFI) and the Tucker-Lewis Index (TLI) greater than 0.90 and 0.95 are regarded as support for adequate and excellent fit (Hu & Bentler, 1999; Marsh et al., 2004; Steiger, 1990). If the upper bound of the RMSEA confidence interval was above a certain threshold (e.g. 0.062), this was regarded as evidence for lower level of fit (in this case, not excellent but good (MacCallum et al., 1996)).

Table 1

Model Fit Statistics for EFA With WLSMV Estimation and 19 Observed Variables for Measurement Model A

Index of model fit	$m = 1$	$m = 5$	$m = 6$	$m = 7$
Chi-square test of model fit				
Value	2472.379	334.802	147.764	91.275
Degrees of freedom	152	86	72	59
p-value	0.000000	0.0000	0.0000	0.0045
RMSEA				
Estimate	0.203	0.088	0.053**	0.038**
90% CI	[0.196; 0.210]	[0.078; 0.098]	[0.041; 0.065]	[0.022; 0.053]
Probability RMSEA $\leq .05$	0.000	0.000	0.316	0.895
CFI	0.777	0.976**	0.993**	0.997**
TLI	0.749	0.952**	0.983**	0.991**
SRMR	0.145	0.033**	0.019**	0.014**

Note. RMSEA=Root Mean Square Error of Approximation; CFI=Comparative Fit Index; TLI=Tucker-Lewis Index; SRMR= Standardized Root Mean Square Residual; m = number of factors in the model; ** indicates good to excellent fit. The solution for $m = 7$ showed the best fit indices, but rotated factor loadings indicated that there was one factor that was poorly measured (i.e., did not have a target item with high loading). The solution for $m = 5$ had borderline acceptable fit but all three items measuring Neighborhood Hazards showed multiple cross-loadings. A model with $m = 6$ met guideline values for good fit and all three Neighborhood Hazards items loaded onto a common factor. A model with only one factor showed the poorest overall fit.

Standardized Root Mean Square Residual (SRMR) values below 0.05 are indication for good fit (Geiser, 2013). Based on fit statistics in Table 1, a model with $m = 6$ was chosen as the best fitting solution. In addition, all factors had at least one target item with a loading higher than 0.6. Table 2 presents Geomin rotated loadings of observed items for a model with six factors.

Table 2

Geomin Rotated Loadings for EFA With WLSMV Estimation, $m = 6$ and 19 Indicators for Measurement Model A

Factor Indicator	Unpredict- ability	Resource Scarcity	Parental Investment	Neighborhood Hazards	Morbidity- Mortality Community	Exposure Violence Aggression
Changes in parental employment	0.730*	<i>0.173*</i>	-0.010	-0.041	0.035	0.031
Changes in residence (moving house)	0.853*	0.014	-0.001	0.078	-0.127*	-0.033
Unrelated male moved in/out of the house	0.436*	<i>-0.132*</i>	-0.023	<i>0.395*</i>	0.072	0.147
My family usually had enough money for things	<i>0.185*</i>	0.592*	-0.037	<i>0.235*</i>	<i>0.097*</i>	<i>-0.106*</i>
Grew up in relatively wealthy neighborhood	-0.053	0.871*	0.053	0.089	-0.052	0.208*
Felt well off compared to other children	0.028	0.898*	<i>-0.115*</i>	-0.086	0.004	0.025
I generally felt safe in my neighborhood	0.012	0.035	-0.098	0.840*	-0.054	0.004
Facilities in neighborhood were in bad condition	0.039	<i>0.193*</i>	0.039	0.505*	<i>0.107*</i>	<i>0.211*</i>
People enjoyed living in my neighborhood	0.025	<i>0.224*</i>	-0.052	0.673*	0.027	-0.053
People in my environment died	0.027	<i>-0.102*</i>	0.036	<i>0.195*</i>	0.628*	0.083
People were sick or suffered from serious illness	-0.036	<i>0.124*</i>	<i>-0.102*</i>	-0.027	0.903*	-0.030
People had physical disabilities or injuries	0.049	0.001	0.009	0.102	0.816*	0.019
Parents responsive to physical & emotional needs	0.062	-0.032	0.841*	-0.161	-0.022	0.038
Parents were stressed when interacting with me	-0.069	0.040	0.639*	0.033	-0.067	<i>-0.243*</i>
Parents spent high quality time with me	0.038	-0.020	0.855*	-0.107	0.029	-0.006
Overall, I had a good relationship with my mother	-0.050	0.080	0.831*	0.023	-0.029	0.021
Overall, I had a good relationship with my father	-0.108	-0.068	0.555*	-0.119	0.080	-0.054
I was exposed to physical violence in environment	-0.020	-0.019	<i>-0.382*</i>	<i>0.248*</i>	0.014	0.668*
I was exposed to verbal aggression in environment	0.046	0.066	<i>-0.547*</i>	-0.041	0.000	0.620*

Note. Anchor indicators of a factor printed in bold; significant cross-loadings printed in italics. See table on p. 39-48 for information on original and final item wording and scoring. * $p < .05$, two-tailed. Some item statements are shortened.

Confirmatory Factor Analysis

In a next step, Confirmatory Factor Analysis (CFA) was applied based on EFA results to test whether a simple structure (i.e., where each item loads on only one factor) with 19 items and six factors provides at least acceptable fit ($RMSEA < 0.8$). Results are presented in Table 3.

Overall, model fit decreased compared to the EFA model, indicated mainly by an increase in RMSEA and a decrease in both CFI and TLI. The increase in misspecification is the result of forcing cross-loadings to be zero when factors are correlated (Hoyle, 2000; Hoyle & Duvall, 2004; Hsu et al., 2014). Using a poor fitting measurement model as a building block of a bigger SEM is not recommended as it negatively affects fit and makes the final model less conclusive.

Table 3

Model Fit Statistics for CFA With WLSMV Estimation and 19 Indicators for Measurement Model A

Index of model fit	$m = 6$
Chi-square test of model fit	
Value	546.765
Degrees of freedom	137
p-value	0.0000
RMSEA	
Estimate	0.090
90% CI	[0.082; 0.098]
Probability RMSEA $\leq .05$	0.000
CFI	0.961**
TLI	0.951**

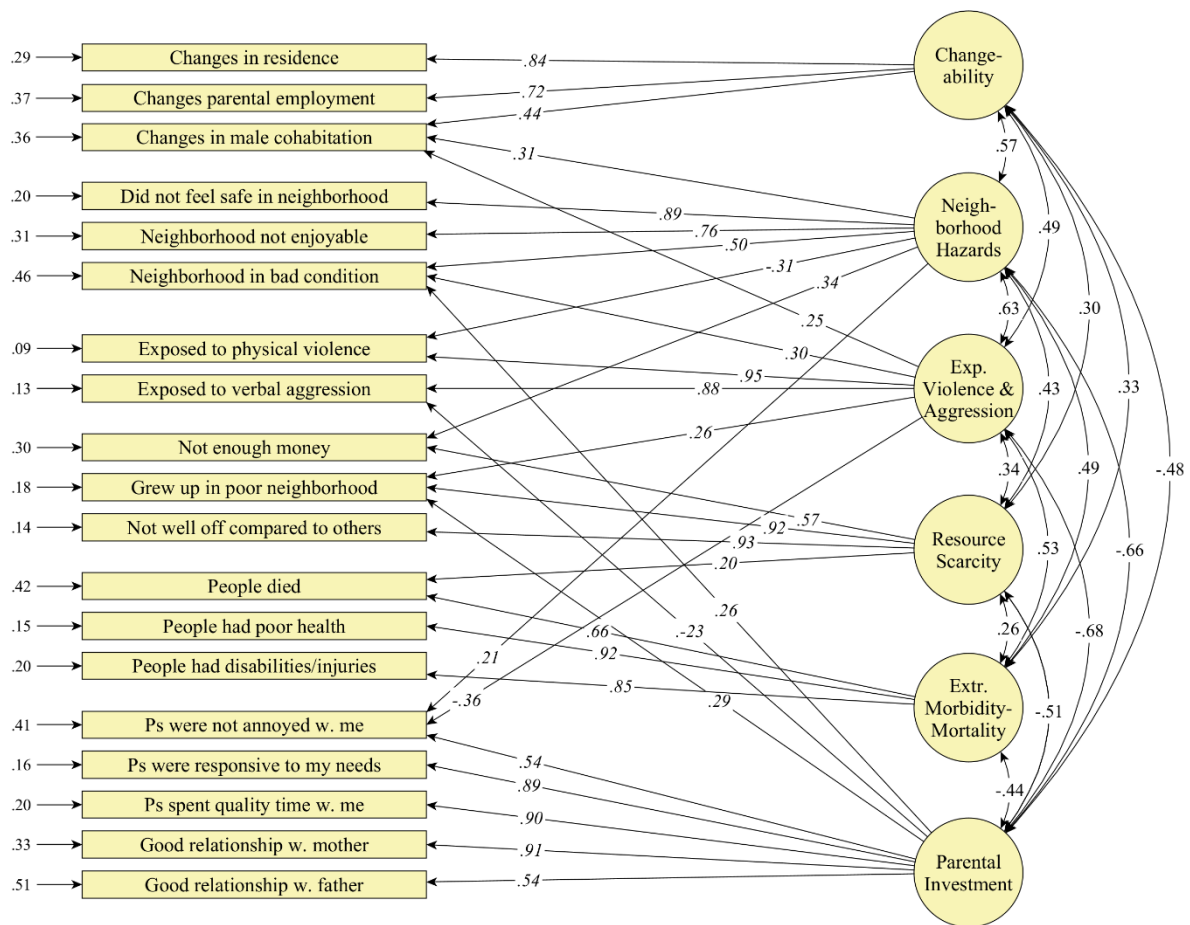
Note. RMSEA=Root Mean Square Error of Approximation; CFI=Comparative Fit Index; TLI=Tucker-Lewis Index; ** indicates excellent fit.

EFA Within a CFA-Framework

To overcome the problem of a poorly fitting measurement model due to correlated factors, an EFA within a CFA-framework (EwC) model was specified by fixing all six factor variances to one, fixing the loading of the anchor item of a factor to zero for all other factors, and using EFA loadings as starting values for the remaining indicators (Howard et al., 2018; Jöreskog, 1969; Mulaik & Millsap, 2000) (see section on Mplus code). Figure 1 illustrates factors, their observed variables, respective residuals and correlations among factors in the EwC model. Fit statistics are shown in Table 4.

Figure 1

Path Diagram of Measurement Model A (EwC) With 19 Indicators and Six Factors Representing Categories of Early Life Stress



Note. All paths are fully standardized (STDYX) and significant with $p < 0.05$, two-tailed. Rectangles represent observed variables/factor indicators; values left of indicators represent residuals; ovals represent latent constructs/factors. Unidirectional arrows between indicators and factors indicate factor loadings; bidirectional arrows indicate factor covariances/correlations. Cross-loadings < 0.2 are omitted for improved readability. See Table 15 for information on original and final item wording and scoring.

Table 4

Model fit Statistics for EwC with WLSMV Estimation and 19 Indicators for Measurement Model A

Index of model fit	$m = 6$
Chi-square test of model fit	
Value	147.761
Degrees of freedom	72
p-value	0.0000
RMSEA	
Estimate	0.053*
90% CI	[0.041; 0.065]
Probability RMSEA $\leq .05$	0.316
CFI	0.993**
TLI	0.983**

Note. RMSEA=Root Mean Square Error of Approximation; CFI=Comparative Fit Index; TLI=Tucker-Lewis Index; *indicates adequate to good fit; **indicates excellent fit.

Factor correlations supported the interpretation that cross-loadings were a result of the intertwined nature of ELS experiences. All indicators showed loadings that were similar to those obtained during EFA. As the CFA and the EwC model stand in nested sequence, a robust chi-square difference test was used to test the null hypothesis that the more restrictive CFA model does not offer significantly better fit compared to the less restrictive EwC model (Kelloway, 2015; Muthén & Muthén, 1998). The result supported the null hypothesis that the CFA model does not provide better fit ($\chi^2_{diff}(20) = 237.988, p = 0.0000$).

Measurement Model C Using Items on Adult Health-Behavior and Risk-Taking

Exploratory Factor Analysis

EFA with WLSMV estimation was performed for solutions with $m = 1$ to 3. A set of eleven items was used, containing four items related to health-behavior, four items related to risk-taking and safety-relevant behavior, as well as the indicators ‘misery delay discounting’,

‘monetary delay discounting’ and ‘time perspective’. The latter two items were excluded from the model as they showed large residual variances and poor loadings regardless of the number of factors. Table 5 shows that a model with $m = 3$ had the best fit. Geomin rotated loadings are presented in Table 6.

The indicator ‘misery delay discounting’ had a relatively weak loading compared to other indicators. The output showed a large residual variance for this item which indicated that a large proportion of variance was not explained by the factor. For the purpose of this study the item was, retained to avoid identification problems, as without this item the respective factor would be measured by only two indicators instead of the required three.

Table 5

Model Fit Statistics for EFA With WLSMV Estimation and Nine Indicators for Measurement Model B

Index of model fit	$m = 1$	$m = 2$	$m = 3$
Chi-square test of model fit			
Value	514.914	114.848	9.520
Degrees of freedom	27	19	12
p-value	0.000000	0.0000	0.6579
RMSEA			
Estimate	0.221	0.117	0.000**
90% CI	[0.204; 0.238]	[0.097; 0.138]	[0.000; 0.043]
Probability RMSEA $\leq .05$	0.000	0.000	0.976
CFI	0.843	0.969**	1.000**
TLI	0.790	0.941*	1.002**

Note. RMSEA=Root Mean Square Error of Approximation; CFI=Comparative Fit Index; TLI=Tucker-Lewis Index. * indicates adequate to good fit; **indicates excellent fit.

Table 6

Geomin Rotated Loadings for EFA With WLSMV Estimation, $m = 3$ and Nine Indicators for Measurement Model B

Factor Indicator	Gratification Before Safety	Detrimental Health-Behavior	Risk-Taking Propensity
Consumption of harmful substances	0.685*	0.144	0.007
Take risk of getting STD	0.471*	-0.019	<i>0.226*</i>
Gambling	0.473*	0.015	0.11
Effort in looking after health	-0.021	-0.779*	-0.095
Way of life suitable to reach old age	0.009	-0.945*	-0.004
Eat fruit and vegetables	0.082	-0.710*	0.014
Safety low priority in traffic	0.031	-0.002	0.824*
Low effort in ensuring safety	-0.006	0.117	0.853*
Misery delay discounting	-0.04	-0.043	0.298*

Notes: Anchor indicators of a factor printed in bold; significant cross-loadings printed in italics.

* $p < .05$, two-tailed. See Table 15 for information on original and final item wording and scoring.

Confirmatory Factor Analysis of Measurement Model C with Second-Order Factor

CFA was applied based on results of the previous EFA to test whether a simple structure with nine items and three factors provides at least acceptable model fit (RMSEA<0.8). A second-order CFA was conducted to test whether the first-order factors reflect a second-order factor, g , and whether model fit is at least acceptable (RMSEA<0.8).

For each first-order factor, the loading of the indicator which showed the highest value in EFA (see Table 6) was fixed at 1 to provide a scale for each factor. The remaining two loadings were freely estimated.

A second-order model with three first-order factors is just-identified¹ with $df = 0$, unless a constraint is imposed on at least one of the parameters to achieve $df = 1$). Here, the residual variances of the factors Gratification before Safety and Risk-Taking Propensity were

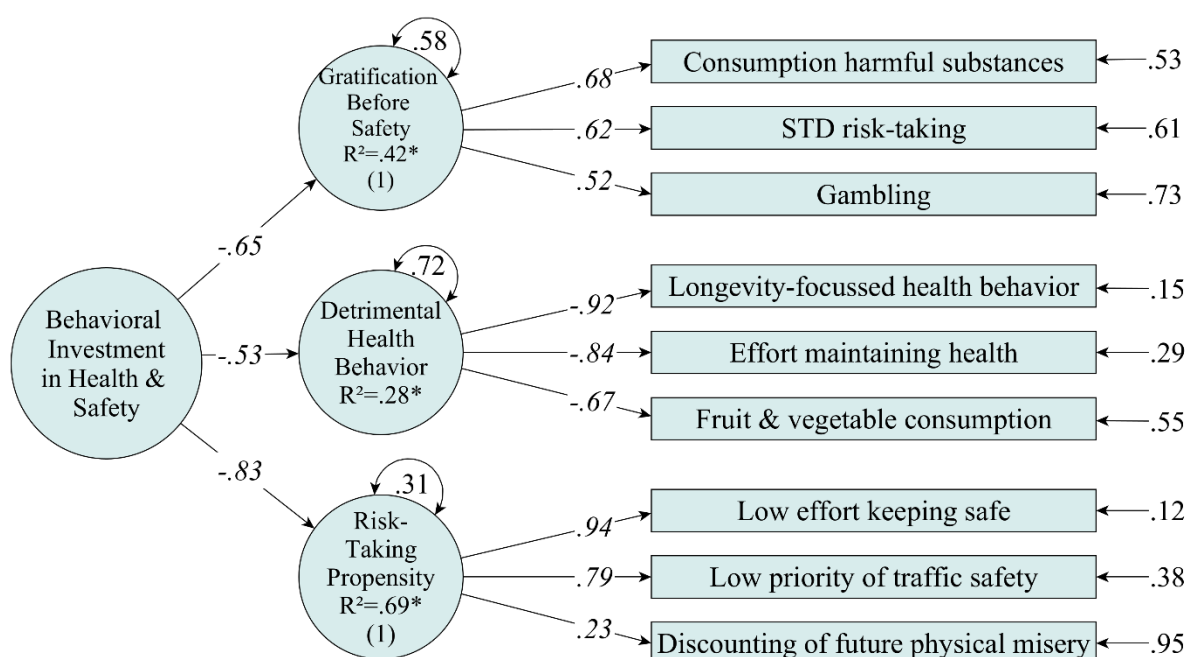
¹ Just-identified models fit the data perfectly and model fit can therefore not be estimated (Kline, 2016).

constrained to be equal, resulting in one degree of freedom at the higher order level of the model (Byrne, 2013).

Figure 2 presents a path diagram with fully standardized (STDYX) factor loadings for the first and second-order elements of the model. First-order loadings were similar to those obtained by EFA, there were no unexpected changes in sign or magnitude and all loadings were significant at $p < 0.05$. Loadings for the second-order factor showed the highest magnitude for Risk-Taking Propensity, followed by Gratification before Safety and Detrimental Health-Behavior. It encompasses a general behavioral tendency to take risks,

Figure 2

Measurement Model C (CFA) With Nine Indicators, Three First-Order and One Second-Order Factor



Note. All depicted paths and values are fully standardized (STDYX) and significant at $p < 0.05$, two-tailed. Rectangles represent observed variables/factor indicators; ovals represent latent constructs/factors; unidirectional arrows indicate factor loadings; residuals are provided for observed variables; R^2 -values and disturbances are provided for latent endogenous variables; (1)=equality constraint on unstandardized residual variances. See Table 15 for information on original and final item wording and scoring.

prioritize gratification over safety and engage in health-behaviors that can lead to premature morbidity-mortality. The second-order factor was named Behavioral Investment in Health and Safety (BIHS).

Loadings changed only slightly in their magnitude when the equality constraint was imposed on the residual variances of Gratification before Safety and Detrimental Health-Behavior. R^2 , the squared factor loading, also referred to as the “communality” of an observed

Table 7 presents results of model fit analysis for a higher order CFA model with $m = 3$ and $g = 1$. This model fit the data well as indicated by RMSEA, CFI and TLI which met criteria for good fit.

Loadings changed only slightly in their magnitude when the equality constraint was imposed on the residual variances of Gratification before Safety and Detrimental Health-Behavior. R^2 , the squared factor loading, also referred to as the “communality” of an observed

Table 7

Model Fit Statistics for a Second-Order CFA Model With WLSMV Estimation, $m = 3$, $g = 1$ and Nine Observable Items

Index of model fit

Chi-square test of model fit	
Value	40.694
Degrees of freedom	25
p-value	0.0247
RMSEA	
Estimate	0.041**
90% CI	[0.015; 0.063]
Probability RMSEA $\leq .05$	0.720
CFI	
	0.995**
TLI	
	0.993**

Note. m = first-order factors; g = second-order factor. RMSEA=Root Mean Square Error of Approximation; CFI=Comparative Fit Index; TLI=Tucker-Lewis Index. ** indicates excellent fit.

variable, gives the amount of variance in an indicator that is explained by its respective factor (Brown & Moore, 2012; Hoyle, 2000). For example, 85.5% of the variance in “My way of life is suitable to reach old age” was explained by the factor Detrimental Health-Behavior ($0.924^2 = 0.855$). Subtracting R^2 from 1 gives the residual variance of an indicator or factor, i.e., the proportion of the variance that is not accounted for by the model, also called “unique variance”.

The item ‘misery delay discounting’ did function as an indicator in this model while ‘monetary delay discounting’ had to be excluded during EFA due to poor loadings.

Measurement Model B Using Items on Age at Puberty, Age at Sexual Debut and Ideal Number of Sexual Partners, Current Number of Children and Ideal Number of Children

Exploratory Factor Analysis

EFA with WLSMV estimation was performed for solutions with $m = 1$ and $m = 2$. Five variables measuring socio-sexual behavior and development as well as current and aspired reproductive success were included in this set: ‘age at puberty’, ‘age at sexual debut’, ‘ideal number of sexual partners in a life-time’, ‘current number of children’ and ‘ideal number of children’. The two variables ‘age at first reproduction’ and ‘ideal age at first reproduction’ were not included as 129 participants indicated they are currently not a parent and 115 indicated that they did not wish to have children in the future, resulting in 129 and 115 cases of missing data for both measures respectively. Including the two variables would have resulted in a reduction of sample size from 371 to 129 and 115 for this part of the model. Table 8 shows model fit statistics for EFA models with one and two factors. A solution with two factors fit the data well.

Table 8*Model Fit Statistics for EFA Models With WLSMV Estimation for $m = 1$ and $m = 2$*

Index of model fit	$m = 1$	$m = 2$
Chi-square test of model fit		
Value	139.045	0.496
Degrees of freedom	5	1
p-value	0	0.4812*
RMSEA		
Estimate	0.269	0**
90% CI	[0.231; 0.308]	[0.000; 0.121]
Probability RMSEA $\leq .05$	0	0.650
CFI	0.595	1**
TLI	0.190	1.015**

Note. RMSEA=Root Mean Square Error of Approximation; CFI=Comparative Fit Index; TLI=Tucker-Lewis Index. ** indicates excellent fit; * indicates good fit.

Table 9 presents Geomin rotated loadings of the five indicators. ‘Age at puberty’, ‘age at sexual debut’, ‘ideal number of sexual partners in a life-time’ reflected a common factor named ‘Socio-Sexual Development and Behavior’ (SSDB) and ‘ideal number of sexual partners’ was inversely related to the other two variables, i.e., the older participants were at puberty and sexual debut, the lower was the number of sexual partners that participants deemed ideal.

Table 9*Geomin Rotated Loadings for EFA With WLSMV Estimation for $m = 2$ and Five Indicators*

Factor Indicator	Socio-Sexual Development and Behavior	Reproductive Effort (current and aspired)
Age at puberty	0.216*	-0.001
Age at sexual debut	0.653*	-0.242
Ideal number of sexual partners	-0.668*	-0.067
Current number of children	-0.011	0.838*
Ideal number of children	0.117	0.773*

Note. * $p < .05$, two-tailed. See Table 15 for information on original and final item wording and scoring.

Confirmatory Factor Analysis

CFA was performed based on EFA results. Model fit statistics in “The latent variable covariance matrix (Psi) is not positive definite. [...] Problem involving variable ‘age at puberty’). All indicators of the factor SSDB are non-significant. Modification indices suggest that the factor ‘Reproduction’ is also measured by ‘age at sexual debut’ (in line with the cross-loading shown in Table 9) and ‘ideal number of sexual partners’. Rather than revising the model based on modification indices and potentially overfitting the model to the specific sample, it was decided to use an ‘EFA in a CFA framework’ (EwC) approach (Asparouhov & Muthén, 2009; Jöreskog, 1969; Marsh et al., 2014; Morin et al., 2013).

Table 10 show that the CFA model fits the data considerably worse than the EFA model. In addition, the Mplus output showed a warning (“The latent variable covariance matrix (Psi) is not positive definite. [...] Problem involving variable ‘age at puberty’). All indicators of the factor SSDB are non-significant. Modification indices suggest that the factor ‘Reproduction’ is also measured by ‘age at sexual debut’ (in line with the cross-loading shown in Table 9) and ‘ideal number of sexual partners’. Rather than revising the model

based on modification indices and potentially overfitting the model to the specific sample, it was decided to use an ‘EFA in a CFA framework’ (EwC) approach (Asparouhov & Muthén, 2009; Jöreskog, 1969; Marsh et al., 2014; Morin et al., 2013).

Table 10

Model Fit Statistics for a CFA Model for $m = 2$

Index of model fit	$m = 2$
Chi-square test of model fit	
Value	21.076
Degrees of freedom	4
p-value	0.0003
RMSEA	
Estimate	0.107
90% CI	[0.065; 0.154]
Probability RMSEA $\leq .05$	0.015
CFI	0.948
TLI	0.871

Note. RMSEA=Root Mean Square Error of Approximation; CFI=Comparative Fit Index; TLI=Tucker-Lewis Index.

EFA in a CFA Framework

To overcome the problem of a poorly fitting confirmatory model, an EwC model was specified by fixing all two factor variances to one, fixing the loading of the anchor item of a factor to zero for the other factor, and using EFA loadings as starting values for the remaining indicators (Howard et al., 2018; Jöreskog, 1969; Mulaik & Millsap, 2000) (see section on Mplus code).

Table 11 shows that the EwC model fit the data very well. Most factor loadings in Table 12 show only small changes in comparison to EFA result in Table 10. However, the loadings of ‘age at sexual debut’ are now significant for both factors.

Table 11

Model Fit Statistics for an ‘EFA in a CFA Framework’ Model for $m = 2$, with Correlated Factors

Index of model fit	$m = 2$
Chi-square test of model fit	
Value	0.496
Degrees of freedom	1
p-value	0.4813*
RMSEA	
Estimate	0**
90% CI	[0.000; 0.121]
Probability RMSEA $\leq .05$	0.650
CFI	1**
TLI	1.015**

Note. RMSEA=Root Mean Square Error of Approximation; CFI=Comparative Fit Index; TLI=Tucker-Lewis Index. ** indicates excellent fit; * indicates good fit.

Table 12*Factor Loadings for an 'EFA in a CFA Framework' Model for $m = 2$ and Five Indicators*

Factor Indicator	Socio-Sexual Development and Behavior	Reproductive Effort (current and aspired)
Age at puberty	0.218*	-0.022
Age at sexual debut	0.658*	-0.306*
Ideal number of sexual partners	-0.676*	0 [†]
Current number of children	0 [†]	0.837*
Ideal number of children	0.128	0.760*

Note. * $p < .05$, two-tailed. † Anchor items of another factor are fixed to zero. See Table 15 for information on original and final item wording and scoring.

Table 13 presents an overview of all observed variables that were excluded during the model building process and are not part of the final model.

Table 13

Observed Variables That Were Excluded During The Model Building Process

Observed variable	Measurement model/proposed factor	Reason for exclusion
“People were affected by mental illness”	MMA/ Extrinsic Morbidity-Mortality	Low loadings relative to other items; did not adequately measure the proposed factor Extrinsic Morbidity-Mortality
“People in my environment were generally in good health”	MMA/ Extrinsic Morbidity-Mortality	
“My parents seemed to be able to cope with events that were out of their control”	MMA/Changeability	Did not reflect the proposed Changeability factor but instead reflected Parental Investment (which was sufficiently measured by other items)
“My parents’ behavior was unpredictable or unreliable”	MMA/Changeability	
“My biological father lived in the same household with me”	MMA/Changeability	Poor measure of Changeability, showed high cross-loadings on Parental Investment
Monetary delay discounting (binary hypothetical choice between a smaller sooner monetary reward and a larger later monetary reward)	MMC	Showed large residual variances and overall poor loadings
Time perspective	MMC	
- Actual age at first reproduction - Ideal age at first reproduction	MMB	115 participants responded that they currently do not have children; 129 participants indicated they would not like to have children in the future, resulting in 115/129 cases of missing data for both measures. Including the two variables would have resulted in a substantial reduction of sample size for this part of the model
Age at puberty	MMB	The variable had a significant loading when included in the EwC model on socio-sexual development and behavior (see Table 12). When the EwC model became part of the final model, its loading was no longer significant. This could be caused by the difference in restrictions in relation to the estimated parameters in the final versus the EwC model.

Full Latent Structural Equation Model

The final step of the model building process consists of estimating paths between latent constructs. Paths between nine latent constructs (six factors measuring ELS experiences; socio-sexual development and behavior; reproductive effort; BIHS) would need to be estimated. The six factors that measure ELS experiences have a substantial amount of shared variance, as indicated by the moderate to high correlations among the factors (see Figure 1). Therefore, it is more parsimonious to capture the shared variance of these six factors by adding a second-order factor that reflects ELS. This will reduce the number of parameters to be estimated in the full latent model from 36 to 12, reducing the complexity and enhancing interpretability.

Table 14 shows a correlation matrix of all variables that are included in the final model.

Table 15 presents information on measurement levels, wording and scoring and Mplus variable names for items that were included in the survey.

Table 14

Correlation Matrix of all Observed Variables Included in the Final Model

	age sexual debut †	ideal n sex. partners ‡	current n of children ‡	ideal n of children ‡	dis- coun- ting future misery †	sub- stance use ‡	health main- tenance effort ‡	HB way of life ‡	HB fruit & veg cons ‡	ELS, changes employ- ment ‡	ELS, changes resi- dence	ELS, changes male cohabi- tation ‡	ELS, enough money ‡	ELS, wealthy nbh ‡	ELS, well off ‡	ELS, felt safe in nbh ‡	ELS, nbh in bad cond. ‡	ELS, people enjoyed nbh ‡	risking STDs ‡	RT in traffic ‡	prioriti- zing safety ‡	gam- bling ‡	ELS, people died ‡	ELS, people were sick ‡	ELS, people injured/ disabl. ‡	ELS, parents respon- sive ‡	ELS, parents annoyed ‡	ELS, parents quality time ‡	ELS, relation- ship mother ‡	ELS, relation- ship father ‡	ELS, physical violence ‡	
ideal n sex. partners ‡	-0.41																															
current n of children ‡	-0.16	-0.1																														
ideal n of children ‡	-0.07	-0.17	0.65																													
discounting future misery †	0.04	-0.05	-0.05	-0.01																												
substance use ‡	0.23	-0.19	-0.04	-0.01	-0.02																											
health maintenance effort ‡	-0.03	-0.07	-0.01	0.06	-0.08	0.31																										
HB way of life ‡	0.01	-0.14	0.01	0.09	-0.03	0.3	0.77																									
HB fruit & veg cons ‡	-0.05	-0.01	-0.03	0.01	-0.03	0.12	0.56	0.65																								
ELS, changes employment ‡	-0.01	0.02	0.11	0.11	0.05	-0.23	-0.13	-0.14	-0.08																							
ELS, changes residence ‡	0.01	0.01	0.09		0.04	-0.21	-0.04	-0.05	0.01	0.65																						
ELS, changes male cohabitation ‡	-0.19	-0.01	0.16	0.15	0.24	-0.31	-0.19	-0.14	-0.04	0.54	0.57																					
ELS, enough money ‡	-0.05	0.02	0.03	0.04	0.05	-0.06	-0.09	-0.02	-0.13	0.45	0.41	0.39																				
ELS, wealthy nbh ‡	-0.02	-0.11	0.08	-0.05	-0.04	0.16	-0.05	-0.06	-0.15	0.29	0.21	0.15	0.64																			
ELS, well off ‡	0.01	-0.06	0.09		0.02	0.11	-0.06	-0.07	-0.21	0.34	0.22	0.17	0.69	0.81																		
ELS, felt safe in nbh ‡	-0.09	0.04	0.06	0.07	0.17	-0.16	-0.07	-0.05	-0.13	0.39	0.44	0.55	0.57	0.33	0.37																	
ELS, nbh in bad cond. ‡	-0.16	0.05	0.05	0.03	0.07	-0.22	-0.14	-0.12	-0.11	0.38	0.35	0.56	0.49	0.46	0.34	0.59																
ELS, people enjoyed nbh ‡	-0.03	0.02	0.07	0.09	0.13	-0.1	-0.13	-0.08	-0.19	0.43	0.37	0.48	0.59	0.47	0.46	0.73	0.56															
risking STDs ‡	-0.2	0.3	-0.14	0.05	0.12	-0.39	-0.17	-0.15	-0.11	0.17	0.09	0.29	0.02	-0.1	-0.14	0.12	0.2	0.12														
RT in traffic ‡	-0.13	0.22	-0.2	-0.05	0.24	-0.26	-0.29	-0.27	-0.17	0.04	0.06	0.32	0.03	-0.2	-0.14	0.16	0.11	0.1	0.31													
prioritizing safety ‡	-0.09	0.23	-0.22	-0.07	0.22	-0.25	-0.41	-0.38	-0.23	0.04	-0.01	0.22	0.01	-0.13	-0.09	0.16	0.08	0.21	0.35	0.74												
gambling ‡	-0.19	0.19	0.07	0.12	0.03	-0.37	-0.15	-0.17	-0.08	0.16	0.02	0.26	0.09	-0.12	-0.1	0.07	0.19	0.07	0.31	0.25	0.25											
ELS, people died ‡	-0.06	0.08	-0.01	0.12	0.11	-0.25	-0.09	-0.07	-0.06	0.29	0.25	0.49	0.28	0.06	0.02	0.38	0.37	0.32	0.28	0.14	0.22	0.26										
ELS, people were sick ‡	-0.07	0.08	0.01	0.14	0.1	-0.25	-0.13	-0.15	-0.13	0.38	0.24	0.42	0.36	0.19	0.24	0.42	0.41	0.42	0.27	0.12	0.19	0.25	0.66									
ELS, people injured/disabl. ‡	-0.14	0.16	-0.03	0.09	0.1	-0.33	-0.13	-0.11	-0.09	0.35	0.32	0.49	0.33	0.12	0.11	0.4	0.48	0.4	0.36	0.17	0.15	0.26	0.67	0.81								
ELS, parents responsive ‡	0.07	-0.05	-0.06	-0.01	-0.18	0.06	0.05	0.09	0.08	-0.38	-0.38	-0.41	-0.53	-0.35	-0.43	-0.58	-0.41	-0.54	-0.1	-0.13	-0.11	-0.04	-0.29	-0.4	-0.36							
ELS, parents annoyed ‡	0.14	-0.09	-0.04	0.01	-0.01	0.12	0.03	0.13	0.04	-0.39	-0.38	-0.43	-0.34	-0.25	-0.27	-0.38	-0.42	-0.35	-0.17	-0.1	-0.08	-0.06	-0.3	-0.4	-0.35	0.65						
ELS, parents quality time ‡	0.07	-0.03	-0.02	-0.02	-0.14	0.06	0.07	0.13	0.09	-0.38	-0.35	-0.46	-0.45	-0.36	-0.43	-0.52	-0.42	-0.49	-0.09	-0.13	-0.08	-0.01	-0.23	-0.37	-0.3	0.82	0.64					
ELS, relationship mother ‡	0.07	-0.02	-0.06	-0.02	-0.16	0.14	0.06	0.08	0.04	-0.33	-0.36	-0.42	-0.36	-0.23	-0.29	-0.39	-0.33	-0.38	-0.21	-0.18	-0.11	0.02	-0.25	-0.34	-0.32	0.72	0.59	0.73				
ELS, relationship father ‡	0.03	-0.1	0.02	0.08	-0.03	0.09	-0.01	0.08	0.06	-0.41	-0.36	-0.32	-0.43	-0.31	-0.37	-0.5	-0.3	-0.44	-0.13	-0.02		-0.01	-0.18	-0.3	-0.26	0.62	0.44	0.59	0.59			
ELS, physical violence ‡	-0.2	0.1	0.16	0.07	0.1	-0.15	-0.05	-0.12	-0.13	0.43	0.39	0.58	0.39	0.37	0.31	0.54	0.54	0.46	0.18	0.06	0.04	0.1	0.45	0.46	0.48	-0.58	-0.62	-0.57	-0.52	-0.53		
ELS, verbal aggression ‡	-0.15	0.1	0.04	-0.04		-0.12	0.01	-0.1	-0.07	0.46	0.38	0.45	0.34	0.37	0.39	0.44	0.44	0.38	0.1	-0.01	-0.01	0.04	0.34	0.43	0.4	-0.62	-0.67	-0.62	-0.54	-0.55	0.86	

Note. RT=risk-taking; HB=health-behavior; ELS=Early Life Stress; nbh=neighborhood; cond=condition; disabl.=disabled; veg=vegetables; n=number. Levels of measurement: †=continuous; ‡=ordered categorical. The type of correlation is determined by the level of measurement of the two variables. Two continuous variables=Pearson product moment correlation. Two ordered categorical variables=polychoric correlation; one continuous, one ordered categorical variable=polyserial correlation.

Table 15

List of all Items Included in the Survey

Demographic measures	Item (observed variable) [Variable name in Mplus]	References	Measurement
Gender *	female/male		unordered categorical
Level of Education *	Education Please indicate your highest achieved educational level Elementary school (1) High school (2) College/University - Undergraduate degree (3) College/University - Graduate degree (4) Doctoral degree (5) Other (6)		unordered categorical
Age *	[enter numerical value]		continuous
Nationality *	[choose from drop-down menu]		unordered categorical
Relationship status *	single divorced widowed partner but not living together partner and living together married		unordered categorical
Country lived in until age 5 *	[choose from drop-down menu]		unordered categorical

Potential latent construct	Item (Observed variable) [Variable name in Mplus]	References	Measurement
Rate of Sexual Maturation	Females: Please indicate at what age you entered puberty by entering a number. This is typically when you experienced your first menstruation. Please write down the age at which you first experienced menstruation here: * [final variable: AGPUBALL]	Adapted from Downing & Bellis (2009), Ellis & Essex, 2007)	continuous
	Males: Please indicate at what age you entered puberty by entering a number. This is typically when you experienced your first ejaculation. Please write down the age at which you first experienced ejaculation here: * [final variable: AGPUBALL]	Adapted from Downing & Bellis (2009), Ellis & Essex, 2007)	continuous
	Please indicate at what age you experienced your sexual debut by entering a number representing your age at that time: NB: Sexual debut can mean sexual intercourse, but also oral sex or other sexual acts. [AGSEXDEB]	Adapted from Simpson, Griskevicius, Kuo, Sung, & Collins (2012); van Brummen-Girigori & Buunk (2015); James et al., (2012); Lohman & Billings, (2008)	continuous
Reproductive/ Mating Effort	Do you have genetically related/biological children?		unordered categorical
	Parents only: How old were you when your first child was born? Please enter your age at that time here: *	Adapted from Nettle (2010a)	continuous
	Non-parents only: Ideally, how old would you like to be when your first (biological) child is born? Please enter a number. If you do not wish to have (biological) children, please enter 0. *	Adapted from Nettle, Coall & Dickins (2010); Pepper and Nettle (2013); Neal et al. (2016)	continuous
	Parents only: How many children do you have? NB: Please fill in all three boxes, enter 0 if you do not have sons/daughters. [final variable: NCHLDALL]	Item based on Belsky et al. (1991); Stearns (1989); Nettle (2010a); Maranges et al., 2022; Mell et al. (2018); Pesonen & Räikkönen (2012); Yuan et al. (2022)	Original variable: count Final variable: 5 ordered categories
	Parents only: Ideally, how many children would you like to have during your life-time? Please enter a number. Include the number of children you already have. For example: If you already have 2 children and would like to have 3 in total, please indicate "3". [final variable: IDNCLDAL]		Original variable: count Final variable: 7 ordered categories
	Non-parents only: Ideally, how many children would you like to have during your life-time? Please enter a number. If you do not wish to have children, please enter 0. ". [final variable: IDNCLDAL]	Item based on Belsky et al. (1991); Stearns (1989); Nettle (2010a); Maranges et al., 2022; Mell et al. (2018); Pesonen & Räikkönen (2012); Yuan et al. (2022)	Original variable: count Final variable: 7 ordered categories
	Thinking about the number of sexual partners a person could have in a lifetime, what do you think would be an ideal number of sexual partners during a life-time? Please enter a number. [final variable: INSXPCAT]	Adapted from Simpson, Griskevicius, Kuo, Sung, & Collins (2012); Belsky, Schlomer & Ellis (2012); Richardson et al. (2014)	Original variable: count Final variable: 9 ordered categories

Potential latent construct	Item (Observed variable) [Variable name in Mplus]	References	Measurement
Time Preference/ Monetary Delay Discounting	For the next questions, please imagine the following scenario: You have won a lottery and have the choice between two monetary prizes: One prize you could claim right now, and a larger amount you could claim at some point in the future. Which would you choose? Please read each question carefully before answering.	Scenario adapted from Chapman & Elstein (1995)	
	If you had the choice, would you rather have \$50 right now, or \$1000 in 1 week from now? * If you had the choice, would you rather have \$100 right now, or \$1000 in 1 week from now? * If you had the choice, would you rather have \$200 right now, or \$1000 in 1 week from now? * If you had the choice, would you rather have \$400 right now, or \$1000 in 1 week from now? * If you had the choice, would you rather have \$600 right now, or \$1000 in 1 week from now? * If you had the choice, would you rather have \$800 right now, or \$1000 in 1 week from now? * If you had the choice, would you rather have \$900 right now, or \$1000 in 1 week from now? *	Adapted from Griskevicius et al. (2011), Adams & Nettle (2009); Bradford (2010); Pepper and Nettle (2013)	Binary choice tasks; the three indifference points serve to create a function; the area under the curve (AUC) is used as the final measure (ranging from 0 to 1, continuous); a high AUC value indicates low discounting. Myerson, Green, & Warusawitharana (2001), Borges, Kuang, Milhorn, & Yi, (2016)
	If you had the choice, would you rather have \$50 right now, or \$1000 in 1 year from now? * If you had the choice, would you rather have \$100 right now, or \$1000 in 1 year from now? * If you had the choice, would you rather have \$200 right now, or \$1000 in 1 year from now? * If you had the choice, would you rather have \$400 right now, or \$1000 in 1 year from now? * If you had the choice, would you rather have \$600 right now, or \$1000 in 1 year from now? * If you had the choice, would you rather have \$800 right now, or \$1000 in 1 year from now? * If you had the choice, would you rather have \$900 right now, or \$1000 in 1 year from now? *		
	If you had the choice, would you rather have \$50 right now, or \$1000 in 25 years from now? * If you had the choice, would you rather have \$100 right now, or \$1000 in 25 years from now? * If you had the choice, would you rather have \$200 right now, or \$1000 in 25 years from now? * If you had the choice, would you rather have \$400 right now, or \$1000 in 25 years from now? * If you had the choice, would you rather have \$600 right now, or \$1000 in 25 years from now? * If you had the choice, would you rather have \$800 right now, or \$1000 in 25 years from now? * If you had the choice, would you rather have \$900 right now, or \$1000 in 25 years from now? *		

Potential latent construct	Item (Observed variable) [Variable name in Mplus]	References	Measurement
Risk-Taking Propensity	The following questions relate to your everyday behavior. Please choose the response that you think best reflects your life style. Please choose a response option for each statement:		ordered categorical (1-7 Likert)
	When engaging in sexual activities with others, I take the risk of getting a sexually transmitted infection [RISKSTD] <i>1=never; 7=extremely frequently</i>	Adapted from Downing & Bellis (2009); Shrestha, Karki and Copenhaver (2015); Belsky, Steinberg, Houts, Halpern-Felsher, & NICHD Early Child Care Research Network (2010); Sandfort et al. (2008); James et al. (2012); Lohman & Billings (2008)	
	When participating in traffic (e.g. as pedestrian, car driver, cyclist) safety is my most important priority. [RISKTRAF] <i>1=extremely frequently; 7=never</i>	Adapted from Hill, Ross, & Low (1997)	
	Overall, I make an effort in ensuring my safety. [RISKSAFE] <i>1=extremely frequently; 7=never</i> Negative wording and reverse scoring for modelling and diagram: Overall, I <i>do not</i> make an effort in ensuring my safety. <i>1=never; 7= extremely frequently</i>	Adapted from Pepper & Nettle (2014); Simpson, Griskevicius, Kuo, Sung and Collins (2012)	
	I gamble (includes betting, lottery, Poker, etc.). [RISKGMBL] <i>1=never; 7=extremely frequently</i>	Adapted from Hill, Ross, & Low (1997); Griskevicius et al. (2011)	
(Preventative) Health-Behavior	The following questions relate to your everyday behavior. Please choose the response that you think best reflects your life style. Please respond to each statement:		ordered categorical (1-7 Likert)
	I have been told that I need to reduce my consumption of harmful substances (e.g. drinking alcohol, smoking tobacco, taking drugs, etc) in order to not risk my health. [HLSUBS] <i>Original scoring: 1=strongly agree; 7=strongly disagree</i> Reverse scoring and sign change for modelling and diagram: <i>1=strongly disagree; 7=strongly agree</i>	Item based on Downing & Bellis (2009), Richardson et al. (2014)	
	Overall, I make an effort in looking after my health (for example, eating healthy, having medical check-ups, exercising, etc.). [HLEFF] <i>1=strongly disagree; 7=strongly agree</i>	Item based on overall preventative health-behavior in Pepper & Nettle (2014); Simpson, Griskevicius, Kuo, Sung and Collins (2012); Bradford (2010)	
	My way of life (e.g. diet, exercising and other habits) is suitable for someone who wants to reach old age. [HLOLDAGE] <i>1= strongly disagree; 7= strongly agree</i>	Item based on overall preventative health-behavior in Pepper & Nettle (2014); Bradford (2010)	
	I eat the recommended daily amounts of fruit and vegetables. [HLFRVEG] <i>1= strongly disagree; 7= strongly agree</i>		

Potential latent construct	Item (Observed variable) [Variable name in Mplus]	References	Measurement
Time Preference/Delay Discounting	Please indicate your response to the following question by choosing the options of your choice.		
	If you were to receive the diagnosis of a potentially life-threatening medical condition right now, how miserable would you feel at that moment?	Based on items measuring happiness about future monetary reward by Kassam, Gilbert, Boston, & Wilson (2008)	ordered categorical (1-5 Likert), final measure AUC continuous (ranging from 0 to 1) Myerson, Green, & Warusawitharana (2001), (Borges et al., 2016) after reverse coding: 0=lowest discounting; 1=highest discounting not at all miserable (1), extremely miserable (5)
	If you were to receive the diagnosis of a potentially life-threatening medical condition one month from now, how miserable would you feel at that moment?		
	If you were to receive the diagnosis of a potentially life-threatening medical condition one year from now, how miserable would you feel at that moment?		
	If you were to receive the diagnosis of a potentially life-threatening medical condition three years from now, how miserable would you feel at that moment?		
	If you were to receive the diagnosis of a potentially life-threatening medical condition 10 years from now, how miserable would you feel at that moment?		
	If you were to receive the diagnosis of a potentially life-threatening medical condition 30 years from now, how miserable would you feel at that moment? [MISDD]		
Time Preference	When you hear someone use the word <i>future</i> , approximately how many years into the future does this mean to you? Please state a number. *	Item by Tonn et al. (2006)	Count/ordered categorical

Potential latent construct	Item (Observed variable) [Variable name in Mplus]	References	Measurement
Perceived Unpredictability	The following questions focus on your perspective and subjective perceptions. Please do not think too long over each question and choose the response that you feel fits best. Please think back to the family environment and living situation in your childhood family, from when you were born to when you were about 5 years old to answer these questions. We are aware that you might only remember things vaguely or that you might have been told stories about things that happened when you were small. Please answer to the best of your knowledge and ability.	Based on approach in Barbaro & Shackelford (2016)	
	Please indicate your response to the following statements. Until I was about 5 years old...		
	There were changes in my mother’s or father’s employment status (e.g. transitioning from being employed to being unemployed). [CHPREMPL] <i>1=never; 7=extremely frequently</i>	Adapted from Barbaro & Shackelford (2016); Belsky, Schlomer and Ellis (2012); Simpson et al., (2012); Szepesenwol et al. (2015, 2017, 2019); Lam et al. (2021)	ordered categorical (1-7 Likert)
	There were changes in residence (for example, moving to a different house or town).[CHRESID] <i>1=never; 7=extremely frequently</i>		
	A genetically unrelated male moved in or out of the house [CHMLMOV] <i>1=never; 7=extremely frequently</i>		
	My parents seemed to be able to cope with events that were out of their control * <i>1=extremely frequently; 7=never</i>	Items based on measures of parental insecurity, conflict, depression, in Ellis & Essex (2007)	
	My parents’ behavior was unpredictable or unreliable * <i>1=never; 7=extremely frequently</i>		

Potential latent construct	Item (Observed variable) [Variable name in Mplus]	References	Measurement
Perceived Resource Scarcity	Please indicate how much you agree or disagree with the following statements. Until I was about 5 years old...		
	My family usually had enough money for things. [RESMON] <i>1= strongly agree; 7= strongly disagree</i> Negative wording and reverse scoring. for final model and diagram: My family usually <i>did not have</i> enough money for things. <i>1= strongly disagree; 7= strongly agree</i>	Items by Griskevicius, Tybur, Delton, & Robertson (2011)	ordered categorical (1-7 Likert)
	I grew up in a relatively wealthy neighborhood. [RESWNBH] <i>1= strongly agree; 7= strongly disagree</i> Negative wording and reverse scoring. for final model and diagram: I grew up in a relatively <i>poor</i> neighborhood. <i>1= strongly disagree; 7= strongly agree</i>		
	I felt relatively well-off compared to other children in my nursery, kinder garden or school. [RESWELOF] <i>1= strongly agree; 7= strongly disagree</i> Negative wording and reverse scoring for final model and diagram: I <i>did not feel</i> relatively well-off compared to other children in my nursery, kinder garden or school. <i>1= strongly disagree; 7= strongly agree</i>		
Perceived Neighborhood Quality	Please indicate your response to the following statements. Until I was about 5 years old...		
	I generally felt safe in my neighborhood (including at home, day-care facilities, playgrounds, etc.). [NBHSAFE] <i>1=always; 7=never</i> Negative wording and reverse scoring for final model and diagram: I generally <i>did not</i> feel safe in my neighborhood... <i>1=never; 7=always</i>	Items based on - Neighborhood quality in Nettle (2010a); - Neighborhood Quality Questionnaire in Buckner (1988); Gonzalez et al. (2016)	ordered categorical (1-7 Likert),
	The buildings, streets and facilities in my environment were run-down or in bad condition. [NBHBADC] <i>1=never; 7=always</i>		
	People around me enjoyed living or spending time in my neighborhood [NBHENJOY] <i>1=always; 7=never</i> Negative wording and reverse scoring for final model and diagram: People around me <i>did not</i> enjoy living or spending time in my neighborhood. <i>1=never; 7=always</i>		

Potential latent construct	Item (Observed variable) [Variable name in Mplus]	References	Measurement
Perceived Exposure to Violence and Aggression	Please indicate your response to the following statements. Until I was about 5 years old...		ordered categorical (1-7 Likert)
	I was exposed to physical violence in my environment. [PHYSVIOL] <i>1=never; 7= extremely frequently</i>	Items based on - Measures of armed conflict in Neal, Stone, & Ingham (2016); - Violent Experiences Questionnaire in Veith et al. (2017)	
	I was exposed to verbal aggression in my environment. [VERBAGGR] <i>1=never; 7= extremely frequently</i>	- Self-report measures of exposure to violence and aggression in Chisholm (1999), Lam et al. (2021)	

Potential latent construct	Item (Observed variable) [Variable name in Mplus]	References	Measurement
Perceived Morbidity-Mortality in the Community	For the following questions, please think back to people that you were surrounded with and who were important or in some way relevant to you and your family when you were growing up (for example close and extended family, neighbors, friends, teachers, etc.). Keep the people referred to above in mind when answering the following questions. Until I was about 5 years old...		
	People in my environment died [PDIED] <i>1=never; 7= extremely frequently</i>	Author-constructed items. Similar - but more objective - measures have been used regarding the present only, not regarding childhood (Pepper & Nettle, 2014; Dunkel, Mathes, & Beaver, 2013). Objective measures of overall life-expectancy and health-deprivation used in Nettle (2010a). Experimental manipulation of exposure to mortality cues in Griskevicius et al. (2011). Mell et al. (2018) used “death of close family member during childhood”.	ordered categorical (1-7 Likert)
	People in my environment were generally in good health * <i>1=extremely frequently; 7=never</i>		
	People in my environment were sick or suffered from serious illness. [PSICK] <i>1=never; 7= extremely frequently</i>		
	People in my environment had physical disabilities or injuries. [PDISAB] <i>1=never; 7= extremely frequently</i>		
	People in my environment were affected by mental illness * <i>1=never; 7= extremely frequently</i>		
Perceived Parental Investment	Please indicate your response to the following statements. Until I was about 5 years old...		
	My parents were responsive to my emotional and physical needs. [PRRESEMO] <i>1=never; 7= extremely frequently</i>	Author-constructed items based on - Parental warmth/positivity by Ellis and Essex (2007) - Child Abuse and Trauma Scale in Hahn et al. (2016) - Childhood Experience of Care and Abuse Interview in Mielke et al. (2016).	ordered categorical (1-7 Likert)
	My parents were stressed or annoyed when interacting with me. [PRANNOY] <i>1=extremely frequently; 7=never</i> Negative wording and reverse scoring for final model: My parents were <i>not</i> stressed or annoyed when interacting with me. <i>1=never; 7= extremely frequently</i>		
	My parents spent high quality time with me (for example: playing together, reading from a book, etc.). [PRQUALTM] <i>1=never; 7= extremely frequently</i>	Author-constructed item based on measures used by Nettle (2010a): "Maternal activities with the child" and "Paternal activities with the child"	
	Overall, I had a good relationship with my mother. [RELMOTH] <i>1=never; 7= extremely frequently</i>	Author-constructed item based on parental supportiveness in Ellis & Essex (2007)	
	My biological father lived in the same household with me * <i>1=never; 7= extremely frequently</i>	Author-constructed item based on father absence; Draper & Harpending (1982); Ellis & Garber (2000); Nettle, Coall, & Dickins, (2010); van Brummen-Girigori & Buunk (2015)	

Potential latent construct	Item (Observed variable) [Variable name in Mplus]	References	Measurement
	Overall, I had a good relationship with my father. [RELFATH] <i>1=never; 7= extremely frequently</i>	Author-constructed item based on parental supportiveness in Ellis & Essex (2007); paternal involvement in Nettle, Coall, & Dickins (2010); father absence in van Brummen-Girigori & Buunk (2015)	

Note: * indicates items that are not part of the final model. For details on the model building process, see section ‘Model Building Process and Intermediate Results’.

The direction of association between factors and between factors and observed items is not only determined by wording and scoring of the item (observed variable) but also on the positive or negative wording of the factor name in the final model.

MPlus Code

TITLE: Final Full Latent Model

DATA: FILE IS "C:[...].dat";

VARIABLE:

NAMES ARE

ID

AGPUBALL AGSEXDEB INSXPCAT NCHLDALL IDNCLDAL

MONDD MISDD MONDDCAT MISDDCAT

HLSUBS HLEFF HLOLDAGE HLFRTVEG

MNGFUT MNGFUTCA

CHPREMPL CHRESID CHMLMOV

PRCOP PRUNPR

RESMON RESWNBH RESWELOF

NBHSafe NBHBADC NBHENJOY

RISKSTD RISKTRAF RISKSafe RISKGMBL

PDIED PGOODHL PSICK PDISAB PMENTILL

PRRESEMO PRANNOY PRQUALTM RELMOTH FATHLIV RELFATH

PHYSVIOL VERBAGGR;

IDVARIABLE=ID;

USEVARIABLES ARE

AGPUBALL AGSEXDEB INSXPCAT NCHLDALL IDNCLDAL
MISDD
HLSUBS HLEFF HLOLDAGE HLFRTVEG
CHPREMPL CHRESID CHMLMOV
RESMON RESWNBH RESWELOF
NBHSAFE NBHBADC NBHENJOY
RISKSTD RISKTRAF RISKSAME RISKGMBL
PDIED PSICK PDISAB
PRRESEMO PRANNOY PRQUALTM RELMOTH RELFATH
PHYSVIOL VERBAGGR;

CATEGORICAL ARE
INSXPCAT NCHLDALL IDNCLDAL
HLSUBS HLEFF HLOLDAGE HLFRTVEG
CHPREMPL CHRESID CHMLMOV
RESMON RESWNBH RESWELOF
NBHSAFE NBHBADC NBHENJOY
RISKSTD RISKTRAF RISKSAME RISKGMBL
PDIED PSICK PDISAB
PRRESEMO PRANNOY PRQUALTM RELMOTH RELFATH
PHYSVIOL VERBAGGR;

MISSING = ALL(-1);

ANALYSIS:

ESTIMATOR=wlsmv;

MODEL:

! MMA/six factors reflecting ELS, with second-order factor:

! EFA in a CFA framework (EwC):

! m squared restrictions are needed for identification,

! (Jöreskog, 1969; Mulaik & Millsap, 2000; Howard, Gagné, Morin, & Forest, 2016)

! i.e., 36 with 6 factors

! 6 factors @1 (6*1) + 5 items per factor @0 (5*6)

! * = parameters are freed; starting values are factor loadings based on

! previous EFA results

fchange BY ! factor Unpredictability

CHPREMPL*0.730

CHRESID*0.853

CHMLMOV*0.436

RESMON*0.185

RESWNBH*-0.053

RESWELOF@0 ! fix all anchor items of other factors to zero

NBHSAFE@0

NBHBADC*0.039

NBHENJOY*0.025

PDIED*0.027

PSICK@0

PDISAB*0.049

PRRESEMO*0.062

PRANNOY*-0.069

PRQUALTM@0

RELMOTH*-0.050

RELFATH*-0.108

PHYSVIOL@0

VERBAGGR*0.046;

fres BY ! factor 'Resource Scarcity'

CHPREMPL*0.173

CHRESID@0

CHMLMOV*-0.132

RESMON*0.592

RESWNBH*0.871

RESWELOF*0.898

NBHSafe@0

NBHBADC*0.193

NBHENJOY*0.224

PDIED*0.102

PSICK@0

PDISAB*0.001

PRRESEMO*-0.032

PRANNOY*0.040

PRQUALTM@0

RELMOTH*0.080

RELFATH*-0.068

PHYSVIOL@0

VERBAGGR*0.066;

fparinv BY ! Factor 'Parental Investment'

CHPREMPL*-0.010

CHRESID@0

CHMLMOV*-0.023

RESMON*-0.037

RESWNBH*0.053

RESWELOF@0
NBHSAFE@0
NBHBADC*0.039
NBHENJOY*-0.052
PDIED*0.036
PSICK@0
PDISAB*0.009
PRRESEMO*0.841
PRANNOY*0.639
PRQUALTM*0.855
RELMOTH*0.831
RELFATH*0.555
PHYSVIOL@0
VERBAGGR*-0.547;

fnbhaz BY ! Factor 'Neighbourhood Hazards'

CHPREMPL*-0.041
CHRESID@0
CHMLMOV*0.395
RESMON*0.235
RESWNBH*0.089
RESWELOF@0
NBHSAFE*0.840
NBHBADC*0.505
NBHENJOY*0.673
PDIED*0.195
PSICK@0
PDISAB*0.102
PRRESEMO*-0.161
PRANNOY*0.033

PRQUALTM@0
RELMOTH*0.023
RELFATH*-0.119
PHYSVIOL@0
VERBAGGR*-0.041;

fmort BY ! Factor 'Morbidity-Mortality in the Community'

CHPREMPL*0.035
CHRESID@0
CHMLMOV*0.072
RESMON*0.097
RESWNBH*-0.052
RESWELOF@0
NBHSAFE@0
NBHBADC*0.107
NBHENJOY*0.027
PDIED*0.628
PSICK*0.903
PDISAB*0.816
PRRESEMO*-0.022
PRANNOY*-0.067
PRQUALTM@0
RELMOTH*-0.029
RELFATH*0.080
PHYSVIOL@0
VERBAGGR*0.000;

fexpxiol BY ! Factor 'Exposure to Violence and Aggression'

CHPREMPL*0.031
 CHRESID@0
 CHMLMOV*0.147
 RESMON*-0.106
 RESWNBH*0.208
 RESWELOF@0
 NBHSAFE@0
 NBHBADC*0.211
 NBHENJOY*-0.053
 PDIED*0.083
 PSICK@0
 PDISAB*0.019
 PRRESEMO*0.038
 PRANNOY*-0.243
 PRQUALTM@0
 RELMOTH*0.021
 RELFATH*-0.054
 PHYSVIOL*0.668
 VERBAGGR*0.620;

! fix factor variances to 1

fchange@1 fres@1 fparinv@1 fnbhaz@1 fmort@1 fexpviol@1;

! fit second-order factor (gels) to capture shared variance of first-order ELS factors

gels BY fchange* fres* fparinv* fnbhaz* fmort* fexpviol*;

! * = all factors are freely estimated

gels@1; !fix variance to 1 for scaling

!MMB/ EwC with two factors reflecting socio-sexual behaviour&development

! and reproductive effort

! EwC requires m-squared restrictions: $2*2=4$

! "*" frees a parameter; starting values are factor loadings obtained

!during previous EFA

fssdb BY !fssdb = factor 'socio-sexual development & behaviour'

AGPUBALL*0.216

AGSEXDEB*0.653

INSXPCAT*-0.668

NCHLDALL@0 ! fix anchor item of other factor to zero

IDNCLDAL*0.117;

frep BY !frep = factor 'reproductive effort'

AGPUBALL*-0.001

AGSEXDEB*-0.242

INSXPCAT@0 ! fix anchor item of other factor to zero

NCHLDALL*0.838

IDNCLDAL*0.773;

fssdb@1 ! fix factor variances to 1

frep@1;

!MMC/CFA with Second-Order Factor on Adult Health and

!Risk-Taking Behaviours

fdhb BY HLOLDAGE HLEFF HLFRTVEG; ! fdhb = detrimental health behaviors (factor)

fgbs BY HLSUBS RISKSTD RISKGMBL; ! fgbs = gratification before safety (factor)

frtp BY RISKSAME RISKTRAF MISDD; !frtp = risk-taking propensity (factor)

gbihs BY fdhb* fgbs* frtp*; ! gbihs is a second-order factor

! "Behavioural Investment in Health & Safety"

! measured by the first-order factors fdhb, fgbs and frtp.

! All loadings are freely estimated (indicated by *).

gbihs@1; ! fix variance at 1 for factor scaling

fgbs frtp (1); ! equality constraints to achieve over-identification with df=1

!for second-order part of the model

!final step: estimate paths between latent constructs for full latent SEM

!a) estimate paths between gELS, Socio-Sexual Development & Behaviour,

! and Reproductive Effort

frep ON gels; !factor 'reproductive effort' is regressed on 2nd order factor 'gELS'.

fssdb ON gels; !factor 'socio-sexual development & behaviour' is regressed on 'gELS'.

!b) the three factors Socio-Sexual Development & Behaviour, Reproductive Effort and gELS

! are regressed on Behavioural Investment in Health & Safety,

gbihs ON gels frep fssdb;

!c) estimate correlation between fssdb and frep

fssdb WITH frep;

OUTPUT:

STANDARDIZED; ! Get standardized loadings

RESIDUAL; ! Request residuals

SAMPSTAT; ! Sample statistics

- Asparouhov, T., & Muthén, B. (2009). Exploratory Structural Equation Modeling. *Structural Equation Modeling: A Multidisciplinary Journal*, 16(3), 397–438.
<https://doi.org/10.1080/10705510903008204>
- Borges, A. M., Kuang, J., Milhorn, H., & Yi, R. (2016). An alternative approach to calculating Area-Under-the-Curve (AUC) in delay discounting research. *Journal of the Experimental Analysis of Behavior*, 106(2), 145–155. <https://doi.org/10.1002/jeab.219>
- Brown, T. A., & Moore, M. T. (2012). Confirmatory Factor Analysis. In R. H. Hoyle (Ed.), *Handbook of Structural Equation Modeling*. Guilford Press.
- Buckner, J. C. (1988). The development of an instrument to measure neighborhood cohesion. *American Journal of Community Psychology*, 16(6), 771–791.
<https://doi.org/10.1007/BF00930892>
- Byrne, B. M. (2013). *Structural Equation Modeling with Mplus: Basic Concepts, Applications, and Programming*. Routledge.
- Chapman, G. B., & Elstein, A. S. (1995). Valuing the Future Temporal Discounting of Health and Money. *Medical Decision Making*, 15(4), 373–386.
<https://doi.org/10.1177/0272989X9501500408>
- Costello, A. B., & Osborne, J. W. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research & Evaluation*, 10(7), 1–9.
- Geiser, C. (2013). *Data analysis with Mplus*. The Guilford Press.
- Hardisty, D. J., Fox-Glassman, K., Krantz, D., & Weber, E. U. (2011). How to Measure Discount Rates? An Experimental Comparison of Three Methods. SSRN.
<http://dx.doi.org/10.2139/ssrn.1961367>

- Howard, J. L., Gagné, M., Morin, A. J., & Forest, J. (2018). Using bifactor exploratory structural equation modeling to test for a continuum structure of motivation. *Journal of Management*, 44(7), 2638–2664. <https://doi.org/10.1177/0149206316645653>
- Hoyle, R. H. (2000). Confirmatory Factor Analysis. In H. E. A. Tinsley & S. D. Brown (Eds.), *Handbook of Applied Multivariate Statistics and Mathematical Modeling*. Academic Press.
- Hoyle, R. H., & Duvall, J. L. (2004). Determining the number of factors in exploratory and confirmatory factor analysis. In D. Kaplan (Ed.), *The Sage Handbook of quantitative methodology for the social sciences* (pp. 301–315).
- Hsu, H.-Y., Troncoso Skidmore, S., Li, Y., & Thompson, B. (2014). Forced Zero Cross-Loading Misspecifications in Measurement Component of Structural Equation Models: Beware of Even “Small” Misspecifications. *Methodology*, 10(4), 138–152. <https://doi.org/10.1027/1614-2241/a000084>
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1–55. <https://doi.org/10.1080/10705519909540118>
- Jöreskog, K. G. (1969). A general approach to confirmatory maximum likelihood factor analysis. *Psychometrika*, 34(2), 183–202. <https://doi.org/10.1007/BF02289343>
- Kelloway, E. K. (2015). *Using Mplus for structural equation modeling: A researcher’s guide* (Second edition). SAGE.
- Kline, R. B. (2016). *Principles and Practice of Structural Equation Modeling* (4th edition). Guilford Press.
- MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods*, 1(2), 130–149. <http://dx.doi.org/10.1037/1082-989X.1.2.130>

- Marsh, H. W., Hau, K.-T., & Grayson, D. (2005). Goodness of fit in structural equation models. In A. Maydeu-Olivares & J. J. McArdle (Eds.), *Contemporary psychometrics*. Lawrence Erlbaum Associates. <http://psycnet.apa.org/psycinfo/2005-04585-010>
- Marsh, H. W., Hau, K.-T., & Wen, Z. (2004). In Search of Golden Rules: Comment on Hypothesis-Testing Approaches to Setting Cutoff Values for Fit Indexes and Dangers in Overgeneralizing Hu and Bentler's (1999) Findings. *Structural Equation Modeling: A Multidisciplinary Journal*, 11(3), 320–341.
https://doi.org/10.1207/s15328007sem1103_2
- Marsh, H. W., Morin, A. J. S., Parker, P. D., & Kaur, G. (2014). Exploratory Structural Equation Modeling: An Integration of the Best Features of Exploratory and Confirmatory Factor Analysis. *Annual Review of Clinical Psychology*, 10(1), 85–110.
<https://doi.org/10.1146/annurev-clinpsy-032813-153700>
- Morin, A. J. S., Marsh, H. W., & Nagengast, B. (2013). Exploratory structural equation modeling. In G. R. Hancock & R. O. Mueller (Eds.), *Structural equation modeling: A second course* (2nd ed., pp. 395–436). Information Age Publishing, Inc.
- Mulaik, S. A., & Millsap, R. E. (2000). Doing the Four-Step Right. *Structural Equation Modeling: A Multidisciplinary Journal*, 7(1), 36–73.
https://doi.org/10.1207/S15328007SEM0701_02
- Muthén, L. K., & Muthén, B. O. (1998-2017). *Mplus User's Guide 8th edition* (8th ed.). Muthén & Muthén.
https://www.statmodel.com/download/usersguide/MplusUserGuideVer_8.pdf
Accessed 15 October 2024.
- Myerson, J., Green, L., & Warusawitharana, M. (2001). Area under the curve as a measure of discounting. *Journal of the Experimental Analysis of Behavior*, 76(2), 235–243.
<https://doi.org/10.1901/jeab.2001.76-235>

- Preacher, K. J., Zhang, G., Kim, C., & Mels, G. (2013). Choosing the Optimal Number of Factors in Exploratory Factor Analysis: A Model Selection Perspective. *Multivariate Behavioral Research*, 48(1), 28–56. <https://doi.org/10.1080/00273171.2012.710386>
- Steiger, J. H. (1990). Structural Model Evaluation and Modification: An Interval Estimation Approach. *Multivariate Behavioral Research*, 25(2), 173–180. https://doi.org/10.1207/s15327906mbr2502_4
- Thompson, B. (2004). *Exploratory and confirmatory factor analysis: Understanding concepts and applications* (1st ed). American Psychological Association.
- Yong, A. G., & Pearce, S. (2013). A beginner's guide to factor analysis: Focusing on exploratory factor analysis. *Tutorials in Quantitative Methods for Psychology*, 9(2), 79–94.