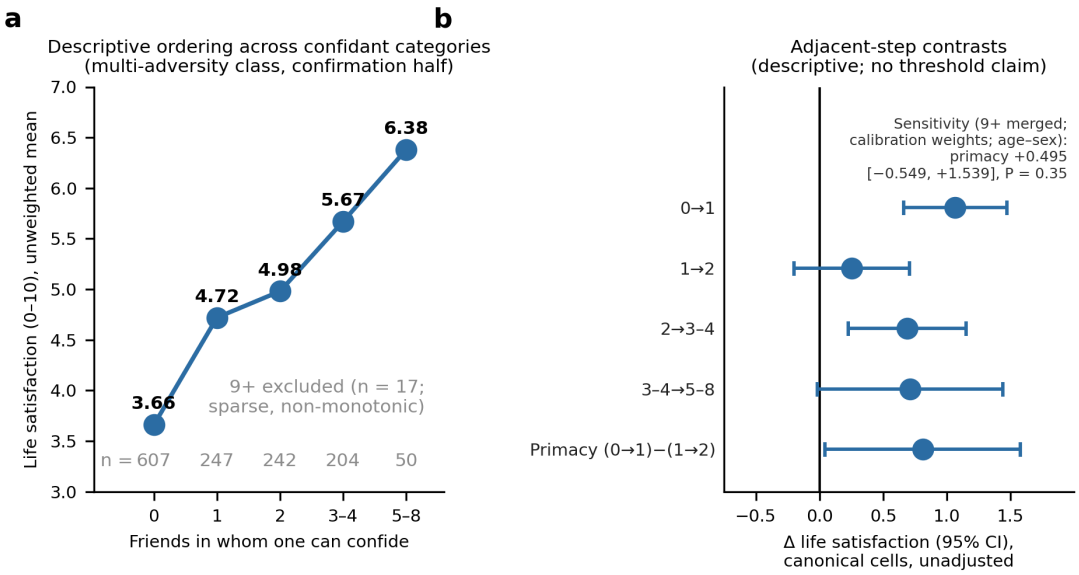
EXTENDED DATA

Extended Data Fig. 1 | Descriptive ordering of life satisfaction across confidant categories of confiding friendships in the multi-adversity class



a, Multi-adversity class, confirmation half (n = 1,367); panel a displays the 1,350 respondents in the five canonical categories. Canonical five-cell means (3.66/4.72/4.98/5.67/6.38; n = 607/247/242/204/50); 9-or-more category excluded (n = 17; sparse, non-monotonic). b, Adjacent-step contrasts and the primacy contrast (+0.81 [+0.05, +1.58], P = 0.038); under sensitivity specifications (9+ merged; calibration weights; age–

sex adjustment) the primacy contrast attenuated (+0.495, 95% CI [−0.549, +1.539], P = 0.35). The first adjacent increment was numerically largest in the canonical unweighted cells; the adjusted primacy contrast was imprecise, and no threshold or primacy claim is made.

Extended Data Table 1 | Components of the crossed-contrast model

Term	Discovery b	Confirmation b	Confirmation 95% CI	Confirmation P	Full-sample b
F × E	+0.206	+0.178	[+0.008, +0.348]	0.041	+0.183
F × D	+0.016	+0.150	[+0.028, +0.272]	0.016	+0.085
M × E	+0.002	−0.222	[−0.397, −0.046]	0.013	−0.105
M × D	+0.335	+0.239	[+0.111, +0.367]	0.00026	+0.286
Contrast L	+0.523 [+0.162, +0.884], P = 0.0046	+0.489	[+0.120, +0.858]	0.0094	+0.489 [+0.229, +0.749], P = 2×10^{-4}

Main effects (confirmation): friend z +0.210 [+0.128, +0.292]; mentor z +0.377 [+0.291, +0.464]; E −0.512 [−0.674, −0.349]; D −0.402 [−0.520, −0.285]; family ties +0.158 [+0.136, +0.180]; age +0.020 [+0.016, +0.023]; female +0.096 [−0.018, +0.210].

Only L is a co-primary test; components are descriptive. The negative M×E term, although negative in 95% of 100 alternative splits (median −0.111), was near zero in the discovery half and is not presented as a confirmed finding.

Extended Data Table 2 | Six retrospective parenting factors (2024 life-course survey; n = 3,422)

Factor	Standardized β	95% CI	P
Parental trust	+0.186	[+0.122, +0.249]	9.1×10^{-9}
Autonomy support	+0.082	[+0.025, +0.140]	5.2×10^{-3}
Norm imposition	−0.063	[−0.108, −0.018]	5.7×10^{-3}
Indifference	−0.054	[−0.095, −0.013]	9.3×10^{-3}
Shared time	+0.020	[−0.021, +0.062]	0.34
Scolding	−0.019	[−0.058, +0.021]	0.36
Contrast: trust − autonomy	+0.103	[−0.008, +0.215]	0.069
Contrast: |trust| − |norm imposition|	+0.123	[+0.051, +0.194]	8.2×10^{-4}

Unstandardized coefficients: Supplementary Table S14. Multicollinearity unproblematic: VIF ≤ 2.6 (trust 2.55, autonomy 2.35, shared time 1.44, norm imposition 1.48, scolding 1.38, indifference 1.23); largest inter-factor correlation r = 0.75 (trust–autonomy), inter-factor correlation summary in Supplementary Table S5. Trust is described as the leading, rather than uniquely dominant, dimension.

Extended Data Table 3 | Joint distribution of event/condition adversity and felt lack of parental love (confirmation half, weighted)

Cell	Weighted %	95% CI	Unweighted n
Neither	46.6	[45.3, 48.0]	6,758
D only	35.1	[33.8, 36.4]	4,742
Both	10.3	[9.5, 11.1]	1,347
E only	8.0	[7.3, 8.7]	1,083

Discordant cells 43.1% (weighted). $\varphi = 0.11$ and OR = 1.77 [1.62, 1.94] are computed from the unweighted counts. 95% CIs for the weighted proportions use a normal approximation, $p \pm 1.96\sqrt{(p(1-p)/n_eff)}$, with the calibration-weighted effective sample size $n_eff = (\Sigma w)^2/\Sigma w^2 = 5{,}342$.

Extended Data Table 4 | LCA estimation diagnostics and class–outcome sensitivity estimates

K	BIC (discovery)	Confirmation-half LL/obs	Restarts within 0.5 log-likelihood units of the best solution
2	109,812	−3.995	120/120
3	105,875	−3.839	120/120
4	104,994	−3.806	120/120 (LL = −52,253.9; entropy 0.789)
5	104,572	−3.791	28/40
6	104,429	−3.783	35/40

Class→outcome estimation (friend × multi-adversity, satisfaction)	b	P
Modal assignment	+0.100	1.3×10^{-3}
Continuous posterior probabilities	+0.120	5.1×10^{-4}
Twenty pseudo-class draws (Rubin's rules)	+0.100	3.2×10^{-3}

The four-class solution is selected descriptively (elbow, interpretability, class size), not as a statistical optimum; confirmation-half log-likelihood improves monotonically with K. Subdivision: K = 5 splits the multi-adversity profile (6.1% + 4.3%; purities 97.1 / 86.5); K = 6 additionally splits the household-adversity profile, with low-adversity and deprivation-dominant classes preserved (purities 98–100). Bias-adjusted BCH-type estimation was not performed. Restarts within 0.5 log-likelihood units of the best solution are counted as solutions within 0.5 log-likelihood units of the best restart; the full restart log (120 restarts for K = 2–4, 40 for K = 5–6) is deposited with the code.

Extended Data Table 5 | Four-class model: interactions and main effects (confirmation half)

Term	b	95% CI / P
Friend × multi-adversity class (ref. low-adversity)	+0.100	[+0.039, +0.161]; P = 1.3×10^{-3}
Friend × deprivation-dominant class	+0.003	P = 0.89
Friend × household-adversity class	+0.003	P = 0.91
Multi-adversity class main effect (at zero friendship ties)	−1.754	[−2.070, −1.439]
Deprivation-dominant class main effect	−1.039	[−1.259, −0.819]
Household-adversity class main effect	−0.431	[−0.818, −0.044]
Friendship main effect	+0.086	[+0.065, +0.106]

Interaction rows for the six principal confirmation-half tests are listed in Table 2; covariates as in Table 2.

Extended Data Table 6 | Specificity of the moderation: direct contrasts

Row	Estimate	95% CI	P
Professional consultation access (any, Q20.7–20.8) × multi-adversity, loneliness	+0.41	[−0.19, +1.01]	0.18
Intergenerational exchange × multi-adversity, loneliness (confirmation)	−0.215	[−0.410, −0.020]	0.030
full sample (precision)	−0.239	[−0.362, −0.115]	1.5×10^{-4}
Direct contrast: friend × multi-adversity − friend × deprivation-dominant	+0.097	[+0.030, +0.164]	0.0047
Direct contrast: informal − professional (common standardized scale, loneliness)	−0.394	[−0.785, −0.003]	0.048
Equivalence (TOST): not performed; no SESOI was pre-specified; nulls are reported as absence of clear evidence of a difference	NA	NA	NA

Significance-pattern comparisons are not treated as evidence of differential moderation[23];

all specificity claims rest on the direct Wald contrasts above.

Extended Data Table 7 | Confidant categories in the multi-adversity class: step contrasts and sensitivity

Step (canonical cells)	Δ	95% CI	P
0→1	+1.067	[+0.663, +1.472]	2.3×10^{-7}
1→2	+0.255	[−0.198, +0.707]	0.27
2→3–4	+0.687	[+0.224, +1.151]	0.0036
3–4→5–8	+0.713	[−0.017, +1.443]	0.055
Primacy (0→1)−(1→2)	+0.813	[+0.045, +1.580]	0.038
Primacy, sensitivity (9+ merged; calibration weights; age–sex adj.; n = 1,367)	+0.495	[−0.549, +1.539]	0.35

Discovery-half first step: 3.62 → 4.58.

Extended Data Table 8 | Father model and parent-sex contrast

Model	b	95% CI	P	n
Father: any non-kin support × own-parent relationship	+0.065	[−0.241, +0.370]	0.68	529 eligible father–child dyads with child well-being data (children aged 4–10 years)
Parent-sex × support × own-parent-relationship contrast	−0.386	[−0.780, +0.008]	0.055	1,041

Mother-model covariates applied throughout.