Delay Discounting in Suicidal Behavior: Myopic Preference or Inconsistent Valuation?

Supplemental Information

Table S1. Sample 1 Sensitivity Analyses: Age, race, education, income, sex

Parameter	Median	89% CI	pd	≈ 2-sided p
β HL SA+MDD	2.150***	[1.674, 2.690]	1.000	0
β Controls (vs. HL SA+MDD)	1.933***	[1.322, 2.497]	1.000	0
β MDD (vs. HL SA+MDD)	2.239***	[1.666, 2.791]	1.000	0
β SI+MDD (vs. HL SA+MDD)	1.055***	[0.627, 1.480]	1.000	0
β LL SA+MDD (vs. HL SA+MDD)	1.197***	[0.718, 1.728]	1.000	0
β Age	-0.488***	[-0.661, -0.307]	1.000	0
β Race	0.796**	[0.360, 1.218]	0.998	0.004
β Education	0.083	[-0.089, 0.266]	0.777	0.446
β Income	0.354**	[0.171, 0.543]	0.999	0.002
β Sex	0.229	[-0.087, 0.581]	0.867	0.266
$k^{subject}$ Controls	0.123	[-0.159, 0.385]	0.765	0.47
$k^{subject}$ MDD	0.375*	[0.140, 0.619]	0.993	0.014
$k^{subject}$ SI+MDD	0.157	[-0.152, 0.445]	0.799	0.402
$k^{subject}$ LL SA+MDD	0.279	[-0.059, 0.603]	0.908	0.184

Note: $k^{subject}$: subject-level discount rate (calculated as $-group\ intercept/group\ \beta$); β: valuation consistency. *p<.05; **p<0.01; ***p<0.001 (two-sided p-value of respectively .05, .01 and .001 corresponds approximately to a *pd* of 97.5%, 99.5% and 99.95%). Dependent variable: Choice (now versus later).

Table S2. Sample 2 Sensitivity Analyses: Age, race, education, income, sex

Parameter	Median	89% CI	pd	≈ 2-sided *p*
β HL SA+MDD	3.619***	[2.579, 4.698]	1.000	0
β Controls (vs. HL SA+MDD)	2.161***	[1.187, 3.147]	1.000	0
β MDD (vs. HL SA+MDD)	3.095***	[2.133, 4.132]	1.000	0
β LL SA+MDD (vs. HL SA+MDD)	0.883	[0.008, 1.782]	0.945	0.11
β Age	-0.950***	[-1.321, -0.587]	1.000	0
β Race	0.059	[-0.877, 0.923]	0.541	0.918
β Education	-0.309	[-0.641, 0.028]	0.930	0.14
β Income	0.111	[-0.282, 0.500]	0.670	0.66
β Sex	-0.129	[-0.791, 0.526]	0.625	0.75
$k^{subject}$ Controls	0.084	[-0.178, 0.361]	0.693	0.614
$k^{subject}$ MDD	0.274	[0.055, 0.489]	0.975	0.05
$k^{subject}$ LL SA+MDD	-0.039	[-0.376, 0.311]	0.573	0.854

Note: $k^{subject}$: subject-level discount rate (calculated as $-group\ intercept/group\ \beta$); β: valuation consistency. *p<.05; **p<0.01; ***p<0.001 (two-sided p-value of respectively .05, .01 and .001 corresponds approximately to a *pd* of 97.5%, 99.5% and 99.95%). Dependent variable: Choice (now versus later).

Table S3. Sample 3 Sensitivity Analyses: Age, race, education, income, sex

Parameter	Median	89% CI	pd	≈ 2-sided *p*
β HL SA+MDD	3.789***	[3.116, 4.491]	1.000	0
β Controls (vs. HL SA+MDD)	0.967*	[0.293, 1.580]	0.993	0.014
β MDD (vs. HL SA+MDD)	1.162**	[0.532, 1.787]	0.999	0.002
β LL SA+MDD (vs. HL SA+MDD)	1.703***	[0.948, 2.477]	1.000	0
β Age	0.294*	[0.072, 0.540]	0.982	0.036
β Race	0.304	[-0.158, 0.791]	0.851	0.298
β Education	0.545***	[0.289, 0.799]	1.000	0
β Income	0.124	[-0.117, 0.350]	0.795	0.41
β Sex	0.151	[-0.332, 0.596]	0.705	0.59
β Site Code	-0.656	[-1.223, -0.131]	0.973	0.054
$k^{subject}$ Controls	-0.095	[-0.389, 0.191]	0.707	0.586
$k^{subject}$ MDD	-0.139	[-0.413, 0.140]	0.794	0.412
$k^{subject}$ LL SA+MDD	0.017	[-0.245, 0.286]	0.545	0.91

Note: $k^{subject}$: subject-level discount rate (calculated as $-group\ intercept/group\ \beta$); β: valuation consistency. *p<.05; **p<0.01; ***p<0.001 (two-sided p-value of respectively .05, .01 and .001 corresponds approximately to a *pd* of 97.5%, 99.5% and 99.95%). Dependent variable: Choice (now versus later).

Table S4. Sample 1 Sensitivity Analyses: Global Cognitive Functioning

Parameter	Median	89% CI	pd	≈ 2-sided *p*
β HL SA+MDD	2.876***	[2.658, 3.103]	1.000	0
β Controls (vs. HL SA+MDD)	1.599***	[1.188, 2.010]	1.000	0
β MDD (vs. HL SA+MDD)	1.613***	[1.197, 2.063]	1.000	0
β SI+MDD (vs. HL SA+MDD)	1.169***	[0.813, 1.514]	1.000	0
β LL SA+MDD (vs. HL SA+MDD)	1.380***	[0.966, 1.804]	1.000	0
β MMSE Score	0.610***	[0.499, 0.714]	1.000	0
$k^{subject}$ Controls	0.10	[-0.171, 0.208]	0.530	0.94
$k^{subject}$ MDD	0.204	[0.022, 0.410]	0.951	0.098
$k^{subject}$ SI+MDD	0.186	[-0.022, 0.390]	0.929	0.142
$k^{subject}$ LL SA+MDD	0.333**	[0.131, 0.538]	0.996	0.008

Note: $k^{subject}$: subject-level discount rate (calculated as $-group\ intercept/group\ \beta$); β: valuation consistency. *p<.05; **p<0.01; ***p<0.001 (two-sided p-value of respectively .05, .01 and .001 corresponds approximately to a *pd* of 97.5%, 99.5% and 99.95%). Dependent variable: Choice (now versus later).

Table S5. Sample 2 Sensitivity Analyses: Global Cognitive Functioning

Parameter	Median	89% CI	pd	≈ 2-sided *p*
β HL SA+MDD	4.195***	[3.573, 4.757]	1.000	0
β Controls (vs. HL SA+MDD)	0.626	[-0.182, 1.383]	0.901	0.198
β MDD (vs. HL SA+MDD)	2.396***	[1.401, 3.323]	1.000	0
β LL SA+MDD (vs. HL SA+MDD)	1.181*	[0.380, 2.011]	0.989	0.022
β MMSE Score	0.852***	[0.615, 1.077]	1.000	0
$k^{subject}$ Controls	-0.183	[-0.468, 0.113]	0.845	0.31
$k^{subject}$ MDD	0.231	[0.007, 0.434]	0.955	0.09
$k^{subject}$ LL SA+MDD	0.074	[-0.213, 0.367]	0.664	0.672

Note: $k^{subject}$: subject-level discount rate (calculated as $-group\ intercept/group\ \beta$); β: valuation consistency. *p<.05; **p<0.01; ***p<0.001 (two-sided p-value of respectively .05, .01 and .001 corresponds approximately to a *pd* of 97.5%, 99.5% and 99.95%). Dependent variable: Choice (now versus later).

Table S6. Sample 3 Sensitivity Analyses: Global Cognitive Functioning

Parameter	Median	89% CI	pd	≈ 2-sided p
β HL SA+MDD	3.859***	[3.282, 4.459]	1.000	0
β Controls (vs. HL SA+MDD)	1.297**	[0.710, 1.926]	0.999	0.002
β MDD (vs. HL SA+MDD)	1.467***	[0.842, 2.051]	1.000	0
β LL SA+MDD (vs. HL SA+MDD)	1.572***	[0.880, 2.284]	1.000	0
β MMSE Score	0.227	[0.021, 0.428]	0.956	0.088
β *Site Code*	-0.825**	[-1.312, -0.361]	0.998	0.004
$k^{subject}$ Controls	-0.122	[-0.388, 0.138]	0.770	0.46
$k^{subject}$ MDD	-0.138	[-0.374, 0.123]	0.816	0.368
$k^{subject}$ LL SA+MDD	0.009	[-0.255, 0.281]	0.522	0.956

Note: $k^{subject}$: subject-level discount rate (calculated as $-group\ intercept/group\ \beta$); β: valuation consistency. *p<.05; **p<0.01; ***p<0.001 (two-sided p-value of respectively .05, .01 and .001 corresponds approximately to a *pd* of 97.5%, 99.5% and 99.95%). Dependent variable: Choice (now versus later).

Table S7. Sample 1. Excluding five participants for whom possible brain injury from suicide attempts could not be ruled out

Parameter	Median	89% CI	pd	≈ 2-sided *p*
β HL SA+MDD	2.562***	[2.342, 2.757]	1	0
β Controls (vs. HL SA+MDD)	1.940***	[1.502, 2.340]	1	0
β MDD (vs. HL SA+MDD)	2.006***	[1.606, 2.428]	1	0
β SI+MDD (vs. HL SA+MDD)	1.365***	[1.014, 1.723]	1	0
β LL SA+MDD (vs. HL SA+MDD)	1.247***	[0.853, 1.644]	1	0
$k^{subject}$ Controls	0.063	[-0.122, 0.269]	0.700	0.6
$k^{subject}$ MDD	0.243	[0.035, 0.430]	0.972	0.056
$k^{subject}$ SI+MDD	0.221	[0.007, 0.437]	0.948	0.104
$k^{subject}$ LL SA+MDD	0.373*	[0.121, 0.593]	0.993	0.014

Note: $k^{subject}$: subject-level discount rate (calculated as $-group\ intercept/group\ \beta$); β: valuation consistency. *p<.05; **p<0.01; ***p<0.001 (two-sided p-value of respectively .05, .01 and .001 corresponds approximately to a *pd* of 97.5%, 99.5% and 99.95%). Dependent variable: Choice (now versus later).

Table S8. Sample 1. Controlling for comorbid substance use and anxiety

Parameter	Median	89% CI	pd	≈ 2-sided p
β HL SA+MDD	3.520***	[3.130, 3.922]	1.000	0
β MDD (vs. HL SA+MDD)	1.837***	[1.403, 2.229]	1.000	0
β SI+MDD (vs. HL SA+MDD)	1.261***	[0.887, 1.603]	1.000	0
β LL SA+MDD (vs. HL SA+MDD)	1.280***	[0.895, 1.704]	1.000	0
β Anxiety Disorder (Lifetime)	-1.369***	[-1.749, -0.979]	1.000	0
β Substance Use (Lifetime)	0.411*	[0.138, 0.712]	0.989	0.022
$k^{subject}$ MDD	0.142	[-0.022, 0.305]	0.914	0.172
$k^{subject}$ SI+MDD	0.106	[-0.069, 0.277]	0.833	0.334
$k^{subject}$ LL SA+MDD	0.234	[0.035, 0.427]	0.970	0.06

Note: $k^{subject}$: subject-level discount rate (calculated as $-group\ intercept/group\ \beta$); β: valuation consistency. *p<.05; **p<0.01; ***p<0.001 (two-sided p-value of respectively .05, .01 and .001 corresponds approximately to a *pd* of 97.5%, 99.5% and 99.95%). Dependent variable: Choice (now versus later).

Table S9. Sample 2. Controlling for comorbid substance use and anxiety

Parameter	Median	89% CI	pd	≈ 2-sided *p*
β HL SA+MDD	4.294***	[3.375, 5.148]	1.000	0
β MDD (vs. HL SA+MDD)	2.116***	[1.032, 3.100]	1.000	0
β LL SA+MDD (vs. HL SA+MDD)	0.104	[-0.828, 1.054]	0.572	0.856
β Anxiety Disorder (Lifetime)	1.230*	[0.440, 2.006]	0.994	0.012
β Substance Use (Lifetime)	-1.060*	[-1.824, -0.279]	0.986	0.028
$k^{subject}$ MDD	0.215	[-0.001, 0.457]	0.930	0.14
$k^{subject}$ LL SA+MDD	-0.018	[-0.387, 0.350]	0.532	0.936

Note: $k^{subject}$: subject-level discount rate (calculated as $-group\ intercept/group\ \beta$); β: valuation consistency. *p<.05; **p<0.01; ***p<0.001 (two-sided p-value of respectively .05, .01 and .001 corresponds approximately to a *pd* of 97.5%, 99.5% and 99.95%). Dependent variable: Choice (now versus later).

Table S10. Sample 3. Controlling for comorbid substance use and anxiety

Parameter	Median	89% CI	pd	≈ 2-sided *p*
β HL SA+MDD	4.598***	[3.619, 5.585]	1.000	0
β MDD (vs. HL SA+MDD)	1.377***	[0.762, 2.015]	1.000	0
β LL SA+MDD (vs. HL SA+MDD)	1.477***	[0.732, 2.194]	1.000	0
β Anxiety Disorder (Lifetime)	-1.304*	[-2.161, -0.477]	0.995	0.01
β Substance Use (Lifetime)	1.216**	[0.462, 1.969]	0.997	0.006
β *Site Code*	-0.504	[-1.130, 0.077]	0.912	0.176
$k^{subject}$ MDD	-0.168	[-0.441, 0.076]	0.862	0.276
$k^{subject}$ LL SA+MDD	-0.030	[-0.279, 0.256]	0.574	0.852

Note: $k^{subject}$: subject-level discount rate (calculated as $-group\ intercept/group\ \beta$); β: valuation consistency. *p<.05; **p<0.01; ***p<0.001 (two-sided p-value of respectively .05, .01 and .001 corresponds approximately to a *pd* of 97.5%, 99.5% and 99.95%). Dependent variable: Choice (now versus later).

Table S11. Sample 1. Excluding non-monotonic responders and those who chose only immediate or only delayed rewards on the MCQ

Parameter	Median	89% CI	pd	≈ 2-sided *p*
β HL SA+MDD	3.605***	[3.323, 3.907]	1.000	0
β Controls (vs. HL SA+MDD)	1.065***	[0.586, 1.529]	1.000	0
β MDD (vs. HL SA+MDD)	0.681*	[0.238, 1.105]	0.993	0.014
β SI+MDD (vs. HL SA+MDD)	0.796**	[0.390, 1.266]	0.999	0.002
β LL SA+MDD (vs. HL SA+MDD)	0.195	[-0.228, 0.660]	0.762	0.476
$k^{subject}$ Controls	-0.069	[-0.222, 0.080]	0.764	0.472
$k^{subject}$ MDD	-0.006	[-0.175, 0.147]	0.524	0.952
$k^{subject}$ SI+MDD	0.045	[-0.103, 0.208]	0.684	0.632
$k^{subject}$ LL SA+MDD	0.066	[-0.128, 0.257]	0.707	0.586

Note: $k^{subject}$: subject-level discount rate (calculated as $-group\ intercept/group\ \beta$); β: valuation consistency. *p<.05; **p<0.01; ***p<0.001 (two-sided p-value of respectively .05, .01 and .001 corresponds approximately to a *pd* of 97.5%, 99.5% and 99.95%). Dependent variable: Choice (now versus later).

Table S12. Sample 2. Excluding responders who chose only immediate or only delayed rewards on the MCQ

Parameter	Median	89% CI	pd	≈ 2-sided *p*
β HL SA+MDD	3.823***	[3.272, 4.394]	1.000	0
β Controls (vs. HL SA+MDD)	1.432**	[0.678, 2.226]	0.997	0.006
β MDD (vs. HL SA+MDD)	2.411***	[1.513, 3.324]	1.000	0
β LL SA+MDD (vs. HL SA+MDD)	0.459	[-0.350, 1.197]	0.823	0.354
$k^{subject}$ Controls	0.058	[-0.154, 0.261]	0.666	0.668
$k^{subject}$ MDD	0.212	[0.035, 0.391]	0.964	0.072
$k^{subject}$ LL SA+MDD	0.097	[-0.187, 0.358]	0.711	0.578

Note: $k^{subject}$: subject-level discount rate (calculated as $-group\ intercept/group\ \beta$); β: valuation consistency. *p<.05; **p<0.01; ***p<0.001 (two-sided p-value of respectively .05, .01 and .001 corresponds approximately to a *pd* of 97.5%, 99.5% and 99.95%). Dependent variable: Choice (now versus later).

Table S13. Sample 3. Excluding responders who chose only immediate or only delayed rewards on the MCQ.

Parameter	Median	89% CI	pd	≈ 2-sided *p*
β HL SA+MDD	3.723***	[3.117, 4.302]	1.000	0
β Controls (vs. HL SA+MDD)	1.210**	[0.589, 1.783]	0.999	0.002
β MDD (vs. HL SA+MDD)	1.582***	[0.943, 2.180]	1.000	0
β LL SA+MDD (vs. HL SA+MDD)	1.561***	[0.870, 2.293]	1.000	0
β Site Code	-0.714*	[-1.172, -0.247]	0.993	0.014
$k^{subject}$ Controls	-0.179	[-0.391, 0.062]	0.891	0.218
$k^{subject}$ MDD	-0.101	[-0.320, 0.103]	0.777	0.446
$k^{subject}$ LL SA+MDD	-0.018	[-0.242, 0.213]	0.549	0.902

Note: $k^{subject}$: subject-level discount rate (calculated as $-group\ intercept/group\ \beta$); β: valuation consistency. *p<.05; **p<0.01; ***p<0.001 (two-sided p-value of respectively .05, .01 and .001 corresponds approximately to a *pd* of 97.5%, 99.5% and 99.95%). Dependent variable: Choice (now versus later).

Table S14. Sample 1. Effects of suicide attempt planning on value sensitivity

Parameter	Median	89% CI	pd	≈ 2-sided *p*
$k^{item}_{indifference}$	3.048***	[2.842, 3.243]	1	0
Attempt Planning	0.674**	[0.292, 1.065]	.997	0.006
$k^{item}_{indifference} * Attempt\ Planning$	-0.327**	[-0.515, -0.134]	.998	0.004

Parameter	Median	89% CI	pd	≈ 2-sided *p*
$k^{item}_{indifference}$	3.167***	[2.958, 3.380]	1	0
Attempt Planning	0.456	[0.057, 0.864]	.963	0.074
Highest Lethality	0.672*	[0.257, 1.107]	.994	0.012
$k^{item}_{indifference} * Attempt\ Planning$	-0.156	[-0.340, 0.033]	.914	0.172
$k^{item}_{indifference} * Highest\ Lethality$	-0.628***	[-0.821, -0.434]	1	0

Note: *p<.05; **p<0.01; ***p<0.001 (two-sided p-value of respectively .05, .01 and .001 corresponds approximately to a *pd* of 97.5%, 99.5% and 99.95%). Dependent variable: Choice (now versus later).

Table S15. Sample 2. Effects of suicide attempt planning on value sensitivity

Parameter	Median	89% CI	pd	≈ 2-sided *p*
$k^{item}_{indifference}$	4.007***	[3.596, 4.439]	1	0
Attempt Planning	-0.405	[-0.994, 0.171]	0.869	0.262
$k^{item}_{indifference} * Attempt\ Planning$	-0.005	[-0.370, 0.364]	0.508	0.984

Note: *p<.05; **p<0.01; ***p<0.001 (two-sided p-value of respectively .05, .01 and .001 corresponds approximately to a *pd* of 97.5%, 99.5% and 99.95%). Dependent variable: Choice (now versus later).

Table S16. Sample 3. Effects of suicide attempt planning on value sensitivity

Parameter	Median	89% CI	pd	≈ 2-sided *p*
$k_{indifference}^{item}$	5.338***	[4.481, 6.222]	1	0
Attempt Planning	0.067	[-0.635, 0.772]	0.559	0.882
Site Code	0.101	[-0.622, 0.765]	0.590	0.82
$k_{indifference}^{item} * Attempt\ Planning$	-0.361	[-0.690, -0.041]	0.957	0.086
$k_{indifference}^{item} * Site\ Code$	-0.532*	[-0.876, -0.188]	0.993	0.014

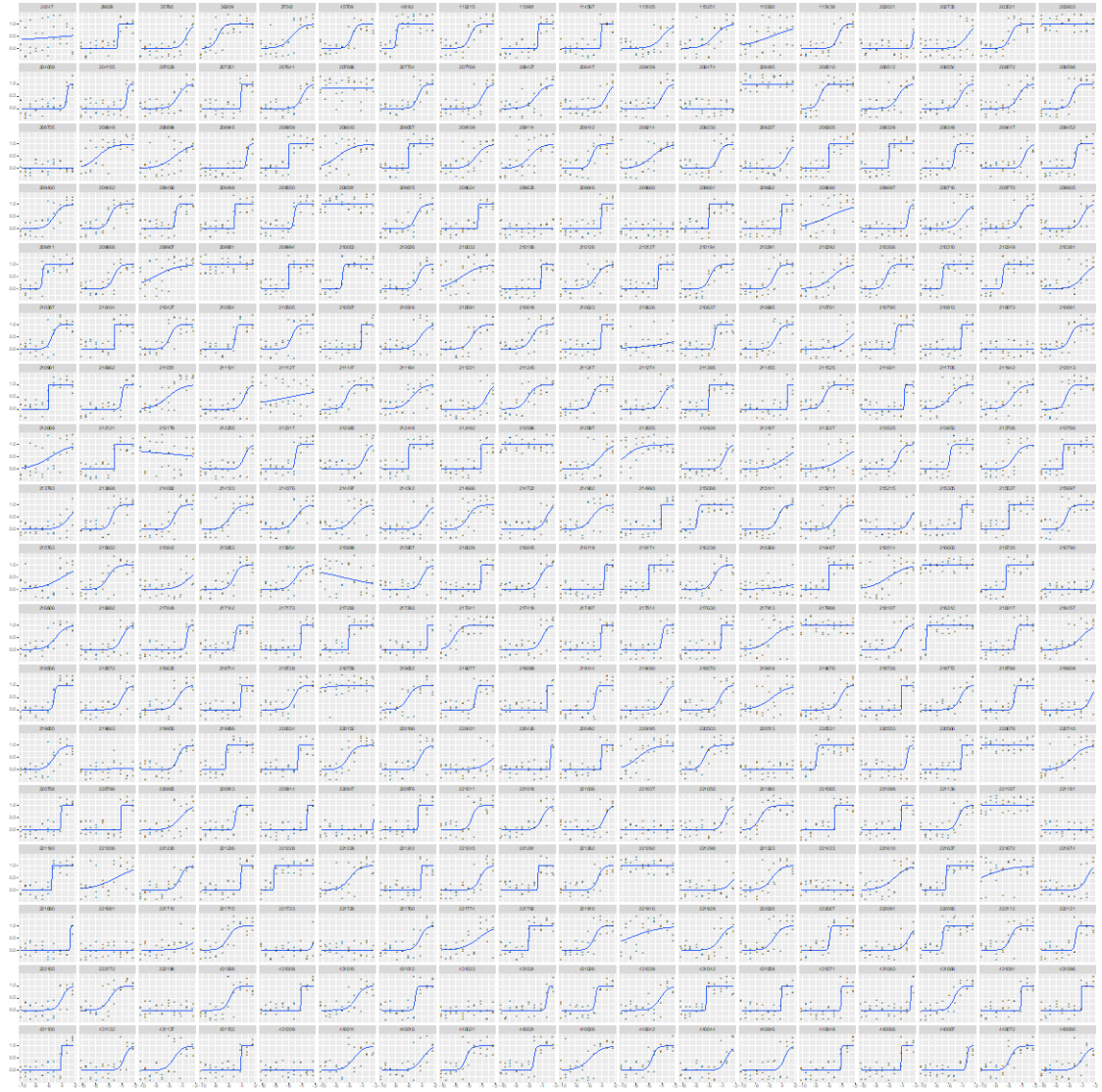
Note: *p<.05; **p<0.01; ***p<0.001 (two-sided p-value of respectively .05, .01 and .001 corresponds approximately to a *pd* of 97.5%, 99.5% and 99.95%). Dependent variable: Choice (now versus later).

Table S17. Subject-level log-transformed discount rates and consistencies

	Sample 1				
	Controls (*n*=66)	**MDD (*n*=66)**	**MDD+SI (*n*=76)**	**MDD+LL SA (*n*=55)**	**MDD+HL SA (*n*=61)**
Discount rates (*M, SD*)	-5.42 (1.62)	-4.97 (1.42)	-4.97 (1.84)	-4.68 (1.75)	-5.00 (1.94)
Consistencies (*M, SD*)	.96 (.04)*	.95 (.04)*	.95 (.06)	.95 (.05)	.92 (.09)*
	Sample 2				
	Controls (*n*=39)	**MDD (*n*=38)**	**MDD+LL SA (*n*=24)**	**MDD+HL SA (*n*=17)**	
Discount rates (*M, SD*)	-5.40 (1.57)	-4.67 (1.19)	-4.75 (1.44)	-4.70 (1.32)	
Consistencies (*M, SD*)	.95 (.04)*	.98 (.02)*	.95 (.04)*	.94 (.06)*	
	Sample 3				
	Controls (*n*=59)	**MDD (*n*=57)**	**MDD+LL SA (*n*=42)**	**MDD+HL SA (*n*=22)**	
Discount rates (*M, SD*)	-5.25 (1.54)	-5.39 (1.80)	-4.91 (1.60)	-4.33 (2.00)	
Consistencies (*M, SD*)	.96 (.04)	.96 (.04)	.95 (.03)	.95 (.06)	

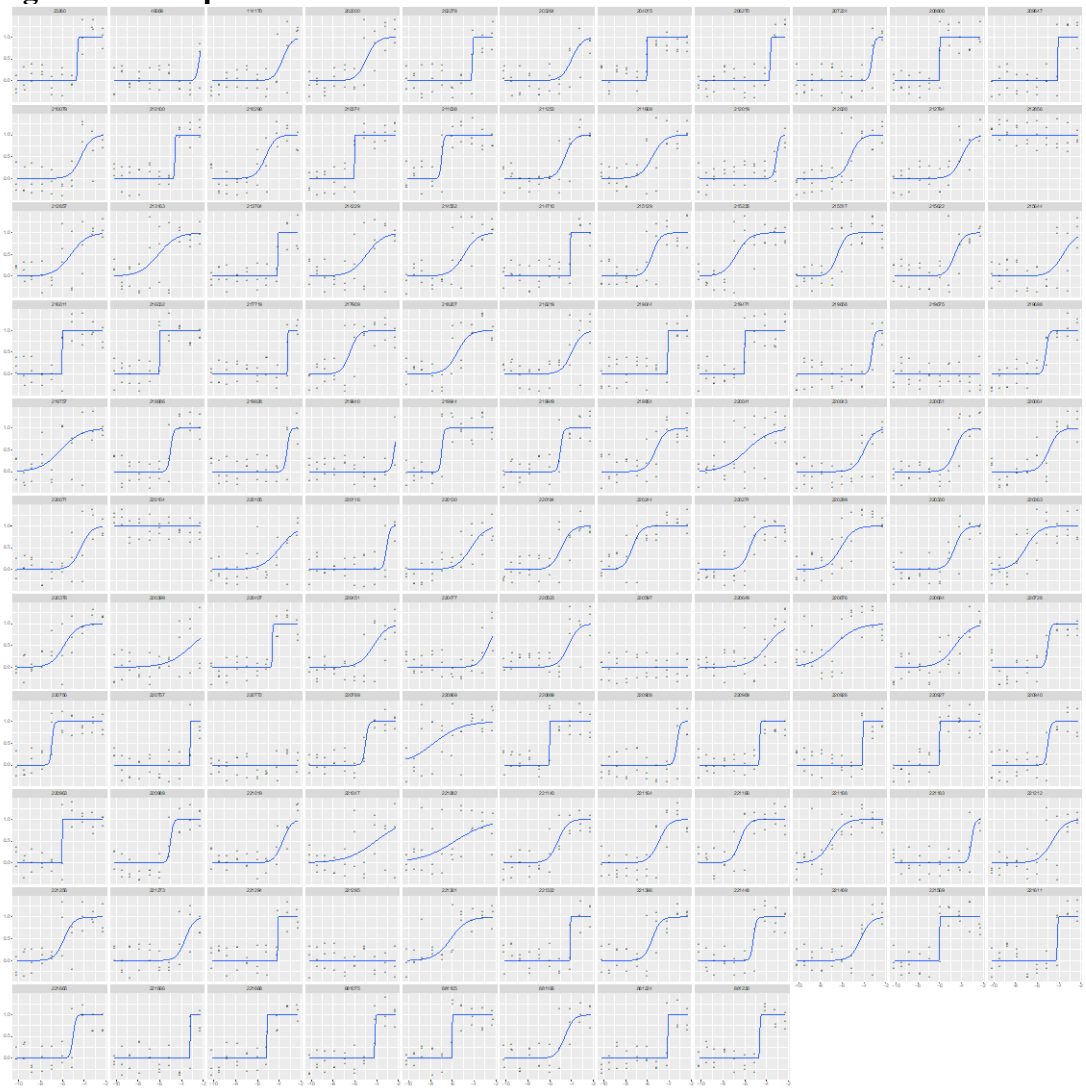
Note. Consistencies indicate the proportion of participants' choices that are consistent with the hyperbolic discount rate.
*$p<0.05$ level.

Figure S1. Sample 1. Task behavior



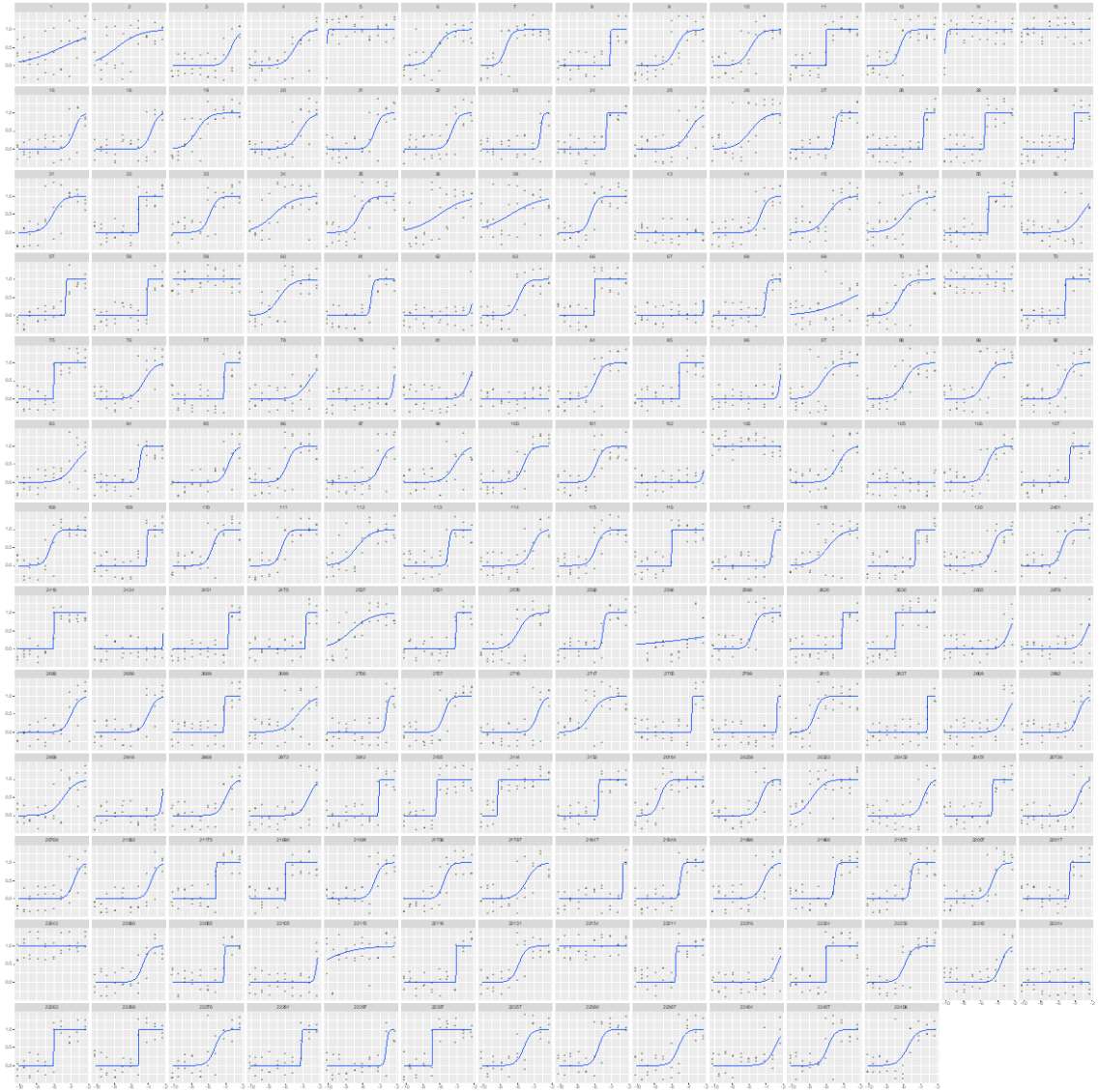
Note. Hyperbolic value difference is on the abscissa and predicted delayed choice probability is on the ordinate.

Figure S2. Sample 2. Task behavior



Note. Hyperbolic value difference is on the abscissa and predicted delayed choice probability is on the ordinate.

Figure S3. Sample 3. Task behavior



Note. Hyperbolic value difference is on the abscissa and predicted delayed choice probability is on the ordinate.