

**Appendix**  
**Adaptive Goals and Reinforcement Timing to Increase Physical Activity in Adults: A Factorial Randomized Trial**  
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**Appendix Table 1.** Effects of Adaptive Goals and Immediate Reinforcement Components on MVPA Outcomes (N=512): Exponentiated Coefficients and 95% CIs (n=133,876 Daily Observations From 512 Participants)

Model term	Any MVPA	Any MVPA	MVPA bout-	MVPA bout-
	minutes/day	minutes/day	minutes/day	minutes/day
	Model 1	Model 2	Model 1	Model 2
	(OR)	(OR)	(IRR)	(IRR)
Adaptive goals (vs static)	0.893 (0.676, 1.167)	0.895 (0.678, 1.183)	1.078 (0.973, 1.193)	1.088 (0.982, 1.206)
Immediate reinforcement (vs delayed)	1.106 (0.838, 1.427)	1.109 (0.839, 1.466)	0.978 (0.883, 1.084)	0.989 (0.892, 1.096)
Phase (0=baseline, 1=intervention)	<b>1.963***</b> (1.821, 2.124)	<b>2.450***</b> (2.250, 2.669)	<b>1.454***</b> (1.416, 1.491)	<b>1.586***</b> (1.542, 1.631)
Adaptive goals x phase	<b>1.407***</b> (1.211, 1.631)	<b>1.557***</b> (1.313, 1.847)	0.972 (0.923, 1.024)	0.999 (0.944, 1.056)
Immediate reinforcement x phase	<b>1.217*</b> (1.048, 1.414)	1.166 (0.983, 1.383)	<b>1.177***</b> (1.117, 1.239)	<b>1.160***</b> (1.097, 1.227)
Days post-randomization		<b>0.796***</b> (0.749, 0.846)		<b>0.914***</b> (0.899, 0.929)
Adaptive goals x days post-randomization		<b>0.856*</b> (0.757, 0.966)		<b>0.952**</b> (0.921, 0.985)
Immediate reinforcement x days post-random		1.018 (0.901, 1.151)		0.990 (0.957, 1.023)
Days post-randomization squared		<b>1.038***</b> (1.021, 1.055)		<b>1.014***</b> (1.010, 1.019)
Adaptive goals x days post-randomization squared		<b>1.042*</b> (1.008, 1.077)		<b>1.012**</b> (1.003, 1.021)
Immediate reinforcement x days post-randomization squared		0.999 (0.966, 1.033)		1.005 (0.996, 1.014)

*Notes:* ORs from random intercepts logistic regression model component for Any MVPA. IRRs = Rate ratios from random intercepts negative binomial model component for Bout Minutes of MVPA. Results reflect adjustment for daily accelerometer wear time (minutes/day) and calendar month. To facilitate model convergence, post-randomization days variable was rescaled by multiplying by 0.01 prior to model estimation. Each model also includes a scaling (dispersion) parameter for the negative binomial component and a

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covariance between the random intercepts of the logistic and negative binomial model components. Boldface indicates statistical significance (\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ ).

MVPA, moderate-to-vigorous physical activity.

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**Appendix Table 2.** Intervention Between-Group Differences in MVPA Outcomes (N=512): Exponentiated Coefficients and 95% CIs (n=133,876 Daily Observations From 512 Participants)

<b>Model term</b>	<b>Any MVPA minutes/day Model 1 (OR)</b>	<b>Any MVPA minutes/day Model 2 (OR)</b>	<b>MVPA bout-minutes/day Model 1 (IRR)</b>	<b>MVPA bout-minutes/day Model 2 (IRR)</b>
Adaptive goals + immediate reinforcement	ref	ref	ref	ref
Static goals + immediate reinforcement	1.045 (0.704, 1.549)	1.040 (0.700, 1.545)	0.874 (0.757, 1.010)	0.871 (0.753, 1.008)
Adaptive goals + immediate reinforcement	0.846 (0.571, 1.252)	0.839 (0.566, 1.245)	0.963 (0.833, 1.112)	0.958 (0.830, 1.110)
Static goals + delayed reinforcement	1.014 (0.684, 1.502)	1.008 (0.679, 1.496)	0.943 (0.817, 1.090)	0.938 (0.811, 1.084)
Phase	<b>2.552***</b> (2.198, 2.965)	<b>3.201***</b> (2.691, 3.808)	<b>1.536***</b> (1.458, 1.618)	<b>1.684***</b> (1.592, 1.780)
Static goals + immediate reinforcement x phase	<b>0.737**</b> (0.595, 0.912)	<b>0.681**</b> (0.533, 0.869)	1.065 (0.990, 1.145)	1.044 (0.964, 1.129)
Adaptive goals + delayed reinforcement x phase	0.851 (0.690, 1.049)	0.909 (0.714, 1.158)	<b>0.882***</b> (0.820, 0.949)	<b>0.897**</b> (0.828, 0.970)
Static goals + delayed reinforcement x phase	<b>0.585**</b> (0.473, 0.723)	<b>0.551***</b> (0.432, 0.702)	<b>0.878***</b> (0.817, 0.945)	<b>0.856***</b> (0.791, 0.926)
Days post-randomization		<b>0.736***</b> (0.644, 0.841)		<b>0.889***</b> (0.859, 0.919)
Static goals + immediate reinforcement x days post-randomization		1.193 (0.996, 1.430)		1.007 (0.961, 1.055)
Adaptive goals + immediate reinforcement x days post-randomization		0.997 (0.836, 1.189)		1.047 (0.998, 1.099)
Static goals + delayed reinforcement x days post-randomization		1.153 (0.965, 1.378)		<b>1.065**</b> (1.015, 1.117)
Days post-randomization squared		<b>1.066***</b> (1.027, 1.106)		<b>1.023***</b> (1.014, 1.033)
Static goals + immediate reinforcement x days post-randomization squared		<b>0.947*</b> (0.901, 0.995)		0.998 (0.975, 1.001)

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Adaptive goals + immediate reinforcement x days post-randomization squared	0.990 (0.944, 1.038)	0.995 (0.982, 1.007)
Static goals + delayed reinforcement x days post-randomization squared	0.958 (0.913, 1.006)	<b>0.982**</b> (0.969, 0.995)

*Notes:* ORs from random intercepts logistic regression model component for Any MVPA. IRRs = Rate ratios from random intercepts negative binomial model component for Bout Minutes of MVPA. Results reflect adjustment for daily accelerometer wear time (minutes/day) and calendar month. To facilitate model convergence, post-randomization days variable was rescaled by multiplying by 0.01 prior to model estimation. Each model also includes a scaling (dispersion) parameter for the negative binomial component and a covariance between the random intercepts of the logistic and negative binomial model components. Boldface indicates statistical significance (\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ ).

MVPA, moderate-to-vigorous physical activity.

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**Appendix Table 3.** Model-Predicted Likelihood of Initiating Any MVPA, Mean MVPA Minutes/Day, and 95% CIs by Intervention Component Level at 60-Day Intervals (N=512)

<b>Intervention component level</b>	<b>Baseline</b>	<b>1</b>	<b>60</b>	<b>120</b>	<b>180</b>	<b>240</b>	<b>300</b>	<b>360</b>
<b>Likelihood of any MVPA/day</b>								
Adaptive goals (n=256)	0.705 (0.661, 0.746)	0.879 (0.858, 898)	0.861 (0.838, 0.882)	0.846 (0.821, 0.868)	0.836 (0.809, 0.859)	0.830 (0.803, 0.854)	0.830 (0.803, 0.854)	0.836 (0.809, 0.861)
Static goals (n=256)	0.728 (0.686, 0.767)	0.840 (0.812, 0.863)	0.828 (0.801, 0.853)	0.818 (0.789, 0.843)	0.809 (0.779, 0.835)	0.801 (0.771, 0.828)	0.795 (0.764, 0.823)	0.791 (0.758, 0.820)
Immediate reinforcement (n=256)	0.727 (0.685, 0.766)	0.876 (0.854, 0.895)	0.863 (0.840, 0.883)	0.852 (0.827, 0.873)	0.843 (0.817, 0.866)	0.838 (0.811, 0.861)	0.836 (0.809, 0.860)	0.838 (0.809, 0.863)
Delayed reinforcement (n=256)	0.706 (0.662, 0.747)	0.845 (0.819, 0.868)	0.828 (0.801, 0.852)	0.813 (0.784, 0.839)	0.801 (0.771, 0.829)	0.794 (0.763, 0.822)	0.790 (0.759, 0.819)	0.791 (0.758, 0.821)
<b>Mean MVPA minutes/day</b>								
Adaptive goals (n=256)	15.55 (14.08, 17.18)	28.40 (26.08, 30.93)	26.31 (24.18, 28.62)	24.80 (22.78, 26.99)	23.82 (21.86, 25.95)	23.30 (21.37, 25.41)	23.24 (21.28, 25.37)	23.60 (21.56, 25.85)
Static goals (n=256)	14.55 (13.18, 16.06)	25.24 (23.14, 27.53)	24.12 (22.13, 26.29)	23.19 (21.26, 25.29)	22.46 (20.58, 24.50)	21.90 (20.06, 23.90)	21.50 (19.69, 23.48)	21.26 (19.42, 23.28)
Immediate reinforcement (n=256)	15.10 (13.68, 16.67)	29.13 (26.8, 31.61)	27.39 (25.26, 29.70)	26.10 (24.06, 28.32)	25.24 (23.23, 27.41)	24.75 (22.77, 26.91)	24.63 (22.64, 26.81)	24.87 (22.80, 27.14)
Delayed reinforcement (n=256)	15.00 (13.68, 16.46)	24.76 (22.90, 26.77)	23.30 (21.56, 25.17)	22.15 (20.48, 23.95)	21.30 (19.69, 23.05)	20.73 (19.15, 22.44)	20.40 (18.84, 22.09)	20.32 (18.73, 22.04)

MVPA, moderate-to-vigorous physical activity.

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**Appendix Table 4.** Model-Predicted Likelihood of Initiating Any MVPA, Mean MVPA Minutes/Day, and 95% CIs by Intervention Group at 60-Day Intervals (N=512)

<b>Intervention group</b>	<b>Baseline</b>	<b>1</b>	<b>60</b>	<b>120</b>	<b>180</b>	<b>240</b>	<b>300</b>	<b>360</b>
<b>Likelihood of any MVPA/day</b>								
Adaptive goals + immediate reinforcement (n=128)	0.723 (0.663, 0.777)	0.893 (0.865, 0.916)	0.877 (0.847, 0.902)	0.864 (0.832, 0.891)	0.856 (0.821, 0.884)	0.853 (0.818, 0.882)	0.856 (0.821, 0.884)	0.864 (0.829, 0.893)
Static goals + immediate reinforcement (n=128)	0.731 (0.671, 0.784)	0.855 (0.820, 0.885)	0.846 (0.8104, 0.876)	0.837 (0.800, 0.869)	0.829 (0.790, 0.861)	0.821 (0.780, 0.855)	0.813 (0.772, 0.849)	0.807 (0.762, 0.846)
Adaptive goals + delayed reinforcement (n=128)	0.687 (0.623, 0.745)	0.864 (0.831, 0.892)	0.844 (0.808, 0.874)	0.826 (0.788, 0.859)	0.813 (0.772, 0.848)	0.805 (0.763, 0.842)	0.803 (0.761, 0.840)	0.808 (0.764, 0.849)
Static goals + delayed reinforcement (n=128)	0.725 (0.665, 0.778)	0.823 (0.782, 0.858)	0.809 (0.768, 0.845)	0.797 (0.754, 0.835)	0.787 (0.743, 0.8264)	0.780 (0.734, 0.820)	0.774 (0.728, 0.815)	0.772 (0.722, 0.815)
<b>Mean MVPA minutes/day</b>								
Adaptive goals + immediate reinforcement (n=128)	15.99 (13.73, 18.62)	30.91 (27.34, 34.94)	28.65 (25.36, 32.37)	27.07 (23.93, 30.62)	26.11 (23.04, 29.59)	25.71 (22.66, 29.17)	25.84 (22.73, 29.38)	26.52 (23.23, 30.27)
Static goals + immediate reinforcement (n=128)	14.00 (11.97, 16.37)	27.17 (23.71, 31.14)	25.94 (22.62, 29.73)	24.93 (21.71, 28.63)	24.15 (20.99, 27.79)	23.58 (20.47, 27.17)	23.21 (20.12, 26.77)	23.02 (19.90, 26.64)
Adaptive goals + delayed reinforcement (n=128)	14.86 (12.90, 17.11)	25.95 (23.24, 28.98)	24.01 (21.49, 26.84)	22.57 (20.15, 25.27)	21.57 (19.23, 24.19)	20.97 (18.69, 23.53)	20.74 (18.49, 23.25)	20.86 (18.59, 23.39)
Static goals + delayed reinforcement (n=128)	15.00 (13.05, 17.24)	23.38 (20.81, 26.27)	22.41 (19.98, 25.12)	21.58 (19.22, 24.22)	20.88 (18.58, 23.47)	20.32 (18.07, 22.86)	19.88 (17.65, 22.40)	19.55 (17.28, 22.12)

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**Appendix Table 5.** Effects of Adaptive Goals and Immediate Reinforcement Components on MVPA Outcomes (N=512): Exponentiated ZINB Coefficients and 95% CIs (n=133,875 Daily Observations From 512 Participants)

Model term	Any MVPA minutes/day		MVPA bout-minutes/day	
	Model 1 (OR)	Model 2 (OR)	Model 1 (IRR)	Model 2 (IRR)
Adaptive goals (vs static)	0.867 (0.652, 1.153)	0.870 (0.652, 1.160)	1.078 (0.974, 1.194)	1.087 (0.981, 1.205)
Immediate reinforcement (vs delayed)	1.099 (0.826, 1.461)	1.118 (0.838, 1.490)	0.979 (0.884, 1.084)	0.992 (0.895, 1.099)
Phase (0=baseline, 1=intervention)	<b>1.943***</b> (1.797, 2.100)	<b>2.423***</b> (2.217, 2.647)	<b>1.459***</b> (1.422, 1.497)	<b>1.592***</b> (1.548, 1.637)
Adaptive goals x phase	<b>1.434***</b> (1.223, 1.675)	<b>1.588***</b> (1.330, 1.896)	0.969 (0.920, 1.020)	0.998 (0.944, 1.055)
Immediate reinforcement x phase	<b>1.204*</b> (1.031, 1.407)	1.168 (0.978, 1.394)	<b>1.174***</b> (1.115, 1.236)	<b>1.159***</b> (1.096, 1.226)
Days post-randomization		<b>0.791***</b> (0.743, 0.842)		<b>0.915***</b> (0.990, 0.930)
Adaptive goals x days post-randomization		<b>0.856*</b> (0.755, 0.971)		<b>0.952**</b> (0.920, 0.984)
Immediate reinforcement x days post-random		1.014 (0.893, 1.150)		0.990 (0.958, 1.024)
Days post-randomization squared		<b>1.040***</b> (1.022, 1.058)		<b>1.014***</b> (1.009, 1.019)
Adaptive goals x days post-randomization squared		<b>1.042*</b> (1.007, 1.078)		<b>1.012**</b> (1.003, 1.021)
Immediate reinforcement x days post-randomization squared		1.000 (0.966, 1.035)		1.005 (0.996, 1.014)

*Notes:* ORs from mixed effects logistic regression model of Any MVPA. IRRs = Rate ratios from mixed effects negative binomial model of Bout Minutes of MVPA. Results reflect adjustment for daily accelerometer wear time (minutes/day) and calendar month. Models also include random participant-level intercept effects. Boldface indicates statistical significance (\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ ).

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MVPA, moderate-to-vigorous physical activity; ZINB, zero inflated negative binomial.

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**Appendix Table 6.** Intervention Between-Group Differences in MVPA Outcomes (N=512): Exponentiated ZINB Coefficients and 95% CIs (n=133,875 Daily Observations From 512 Participants)

Model term	Any MVPA minutes/day	Any MVPA minutes/day	MVPA bout-minutes/day	MVPA bout-minutes/day
	Model 1 (OR)	Model 2 (OR)	Model 1 (IRR)	Model 2 (IRR)
Adaptive goals + immediate reinforcement	ref	ref	ref	ref
Static goals + immediate reinforcement	1.083 (0.724, 1.621)	1.088 (0.726, 1.623)	0.877 (0.759, 1.012)	0.880 (0.761, 1.018)
Adaptive goals + immediate reinforcement	0.849 (0.569, 1.268)	0.851 (0.570, 1.271)	0.964 (0.834, 1.113)	0.952 (0.824, 1.101)
Static goals + delayed reinforcement	1.047 (0.700, 1.566)	1.047 (0.700, 1.566)	0.941 (0.815, 1.087)	0.935 (0.809, 1.081)
Phase	<b>2.654***</b> (2.274, 3.096)	<b>3.300***</b> (2.783, 3.984)	<b>1.546***</b> (1.468, 1.628)	<b>1.679***</b> (1.587, 1.775)
Static goals + immediate reinforcement x phase	<b>0.734**</b> (0.589, 0.915)	<b>0.677**</b> (0.526, 0.872)	1.052 (0.978, 1.131)	1.037 (0.959, 1.123)
Adaptive goals + delayed reinforcement x phase	0.869 (0.701, 1.078)	0.923 (0.720, 1.184)	<b>0.876***</b> (0.814, 0.942)	<b>0.896**</b> (0.828, 0.970)
Static goals + delayed reinforcement x phase	<b>0.581***</b> (0.467, 0.723)	<b>0.544***</b> (0.423, 0.699)	<b>0.868***</b> (0.807, 0.933)	<b>0.860***</b> (0.795, 0.931)
Days post-randomization		<b>0.735***</b> (0.640, 0.844)		<b>0.889***</b> (0.859, 0.919)
Static goals + immediate reinforcement x days post-randomization		1.201 (0.996, 1.449)		1.046 (0.997, 1.097)
Adaptive goals + immediate reinforcement x days post-randomization		1.011 (0.842, 1.214)		1.010 (0.964, 1.058)
Static goals + delayed reinforcement x days post-randomization		1.161 (0.966, 1.396)		<b>1.066**</b> (1.016, 1.118)
Days post-randomization squared		<b>1.065**</b> (1.026, 1.107)		<b>1.023***</b> (1.014, 1.033)
Static goals + immediate reinforcement x days post-randomization squared		<b>0.942*</b> (0.895, 0.992)		0.988 (0.975, 1.001)

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Adaptive goals + immediate reinforcement x days post-randomization squared	0.987 (0.940, 1.038)	0.993 (0.981, 1.007)
Static goals + delayed reinforcement x days post-randomization squared	0.960 (0.913, 1.009)	<b>0.982**</b> (0.969, 0.995)

*Notes:* ORs from mixed effects logistic regression model of Any MVPA. IRRs = Rate ratios from mixed effects negative binomial model of Bout Minutes of MVPA Results reflect adjustment for daily accelerometer wear time (minutes/day) and calendar month. Models also include random participant-level intercept effects. Boldface indicates statistical significance (\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ ).

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