

Supplementary Online Content

Patel MS, Small DS, Harrison JD, et al. Effectiveness of behaviorally designed gamification interventions with social incentives for increasing physical activity among overweight and obese adults across the United States: the STEP UP randomized clinical trial. *JAMA Intern Med.* Published online September 9, 2019. doi:10.1001/jamainternmed.2019.3505

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This supplementary material has been provided by the authors to give readers additional information about their work.

eTable 1. Missing data rates by arm and study period

	Control (n = 151)	Gamification with Support (n = 151)	Gamification with Collaboration (n = 150)	Gamification with Competition (n = 150)
Weeks 1-4 (Ramp-up period)				
Missing data	274/4228 (6.5%)	286/4228 (6.8%)	183/4200 (4.4%)	158/4200 (3.8%)
Step values < 1000	143/4228 (3.4%)	85/4228 (2.0%)	82/4200 (2.0%)	53/4200 (1.3%)
Weeks 5-24 (Main intervention period)				
Missing data	6091/21140 (28.8%)	5342/21140 (25.3%)	5501/21000 (26.2%)	3938/21000 (18.8%)
Step values < 1000	656/21140 (3.1%)	549/21140 (2.6%)	576/21000 (2.7%)	411/21000 (2.0%)
Weeks 25-36 (Follow-up period)				
Missing data	6330/12684 (49.9%)	6354/12684 (50.1%)	7015/12600 (55.7%)	5233/12600 (41.5%)
Step values < 1000	379/12684 (3.0%)	274/12684 (2.2%)	276/12600 (2.2%)	295/12600 (2.3%)

Data is presented at the participant-day level. For example, in control there were 151 patients in a 4-week ramp-up period. For example, 151 participants x 4 weeks x 7 days/week = 4228 participant-days for that period.

eTable 2. Distribution of participants by arm and US Census Region

N (% within arm)	Control (N = 151)	Gamification with Support (N = 151)	Gamification with Collaboration (N = 150)	Gamification with Competition (N = 150)
Northeast	23 (15.2)	32 (21.2)	34 (22.7)	36 (24.0)
Midwest	24 (15.9)	24 (15.9)	23 (15.3)	19 (12.7)
South	81 (53.6)	71 (47.0)	72 (48.0)	75 (50.0)
West	23 (15.2)	24 (15.9)	21 (14.0)	20 (13.3)

eTable 3. Unadjusted changes in daily step by arm and baseline step count

		Control (N = 151)	Gamification with Support (N = 151)	Gamification with Collaboration (N = 150)	Gamification with Competition (N = 150)
Baseline steps < 5000	N	59	58	56	56
	Baseline step count, mean (SD)	3813 (818)	3889 (772)	3898 (824)	3902 (712)
	Change in daily steps from baseline to intervention, mean (SD)	1065 (1624)	1698 (1574)	1549 (1191)	1358 (1212)
	Change in daily steps from baseline to follow-up, mean (SD)	1048 (1587)	1349 (1507)	1241 (994)	1100 (1383)
Baseline steps 5001 - 7500	N	54	52	55	55
	Baseline step count, mean (SD)	6115 (751)	6301 (736)	6036 (727)	6063 (725)
	Change in daily steps from baseline to intervention, mean (SD)	37 (1288.2)	373 (1821)	826 (1676)	1088 (1591)
	Change in daily steps from baseline to follow-up, mean (SD)	-172 (1426)	-252 (1571)	-48 (1494)	457 (1549)
Baseline steps 7501- 10000	N	27	26	30	26
	Baseline step count, mean (SD)	8445 (601)	8589 (687)	8508.8 (722.8)	8809 (761)
	Change in daily steps from baseline to intervention, mean (SD)	-758 (1736)	166 (1880)	-148.2 (2291.5)	390 (2486.8)
	Change in daily steps from baseline to follow-up, mean (SD)	-1335 (2116)	-666 (1753)	-1378.3 (1526.8)	-744.8 (2667.4)
Baseline steps >10000	N	11	15	9	13
	Baseline step count, mean (SD)	12340 (274)	11622 (1194)	12506 (3494)	12766 (2502)
	Change in daily steps from baseline to intervention, mean (SD)	-2987 (3089)	-1319 (2742)	-2628 (4224)	-564 (3734)

	Change in daily steps from baseline to follow-up, mean (SD)	-4065 (3433)	-1828 (3360)	-4210 (3547)	-1961 (3550)
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Abbreviations: SD, standard deviation

*Changes in daily step counts are unadjusted and based on imputed data

eTable 4. Adjusted differences in daily steps between the gamification arms using multiple imputation

	Gamification with Competition vs. Gamification with Support	Gamification with Competition vs. Gamification with Collaboration	Gamification with Support vs. Gamification with Collaboration
Main intervention period			
Main adjusted model			
Difference relative to control and adjusted for baseline (95% CI)	245 (-183, 673)	296 (-131, 723)	65 (-342, 471)
<i>P</i> value	0.26	0.17	0.76
Fully adjusted model			
Difference relative to control and adjusted for baseline (95% CI)	276 (-155, 707)	205 (-227, 638)	-37 (-440, 366)
<i>P</i> value	0.21	0.35	0.86
Follow-up period			
Main adjusted model			
Difference relative to control and adjusted for baseline (95% CI)	162 (-257, 581)	448 (-66, 830)	301 (-61, 663)
<i>P</i> value	0.45	0.02	0.10
Fully adjusted model			
Difference relative to control and adjusted for baseline (95% CI)	110 (-312, 531)	360 (-32, 752)	274 (-88, 637)
<i>P</i> value	0.61	0.07	0.14

Abbreviations: CI, confidence interval

eTable 5. Adjusted differences in daily steps without multiple imputation

	Control	Gamification with Support	Gamification with Collaboration	Gamification with Competition	Gamification with Competition vs. Gamification with Support	Gamification with Competition vs. Gamification with Collaboration	Gamification with Support vs. Gamification with Collaboration
Main intervention period							
Steps per day, mean (SD)	5855 (2352)	6688 (2614)	6607 (2404)	7147 (2995)	-	-	-
Main adjusted model							
Difference relative to control and adjusted for baseline (95% CI)	-	743 (301, 1185)	737 (298, 1175)	1134 (693, 1574)	411 (-54, 876)	422 (-46, 890)	17 (-452, 487)
<i>P</i> value	-	0.001	0.001	<.001	0.08	0.08	0.94
Fully adjusted model							
Difference relative to control and adjusted for baseline (95% CI)	-	791 (350, 1231)	766 (323, 1209)	1157 (701, 1612)	389 (701, 1612)	321 (-154, 795)	-62 (-524, 400)
<i>P</i> value	-	<.001	<.001	<.001	0.10	0.19	0.79
Follow-up period							
Steps per day, mean (SD)	5333 (2407)	6122 (2686)	5596 (2103)	6287 (2947)	-	-	-
Main adjusted model							
Difference relative to control and adjusted for baseline (95% CI)	-	563 (2, 1124)	248 (-261, 759)	705 (153, 1257)	190 (-367, 748)	434 (-87, 955)	289 (-241, 818)
<i>P</i> value	-	0.049	0.34	0.01	0.50	0.10	0.29
Fully adjusted model							
Difference relative to control and adjusted for baseline (95% CI)	-	552 (-12, 1115)	259 (-264, 783)	655 (82, 1228)	191 (-371, 752)	384 (-160, 927)	234 (-301, 768)
<i>P</i> value	-	0.06	0.33	0.03	0.51	0.17	0.39

Abbreviations: CI, confidence interval

eTable 6. Adjusted differences in daily steps without multiple imputation and excluding step values <1000

	Control	Gamification with Support	Gamification with Collaboration	Gamification with Competition	Gamification with Competition vs. Gamification with Support	Gamification with Competition vs. Gamification with Collaboration	Gamification with Support vs. Gamification with Collaboration
Main intervention period							
Steps per day, mean (SD)	6193 (2205)	6942 (2490)	6894 (2276)	7333 (2968)	-	-	-
Main adjusted model							
Difference relative to control and adjusted for baseline (95% CI)	-	674 (259, 1090)	732 (322, 1142)	1020 (596, 1444)	367 (-82, 815)	312 (-138, 761)	-47 (-489, 395)
<i>P</i> value	-	0.002	<.001	<.001	0.11	0.17	0.84
Fully adjusted model							
Difference relative to control and adjusted for baseline (95% CI)	-	726 (308, 1143)	731 (319, 1142)	1033 (593, 1473)	352 (-96, 799)	213 (-242, 668)	-115 (-549, 320)
<i>P</i> value	-	<.001	<.001	<.001	0.12	0.36	0.61
Follow-up period							
Steps per day, mean (SD)	5737 (2235)	6535 (2624)	5962 (1933)	6565 (2930)	-	-	-
Main adjusted model							
Difference relative to control and adjusted for baseline (95% CI)	-	534 (9, 1059)	243 (-237, 723)	606 (71, 1141)	120 (-415, 655)	359 (-151, 868)	272 (-224, 769)
<i>P</i> value	-	0.046	0.32	0.03	0.66	0.17	0.28
Fully adjusted model							
Difference relative to control and adjusted for baseline (95% CI)	-	523 (-11, 1057)	239 (-251, 729)	552 (-6, 1110)	114 (-427, 655)	308 (-223, 839)	238 (-270, 730)
<i>P</i> value	-	0.05	0.34	0.05	0.68	0.26	0.37

Abbreviations: CI, confidence interval

eTable 7. Adjusted differences in the proportion of participant-days step goals were achieved without multiple imputation

	Gamification with Competition vs. Gamification with Support	Gamification with Competition vs. Gamification with Collaboration	Gamification with Support vs. Gamification with Collaboration
Main intervention period			
Main adjusted model			
Difference relative to control (95% CI)	0.05 (0.03, 0.07)	0.05 (0.04, 0.07)	0.01 (-0.01, 0.02)
<i>P</i> value	0.07	0.06	0.97
Fully adjusted model			
Difference relative to control (95% CI)	0.05 (0.03, 0.07)	0.05 (0.04, 0.07)	0.01 (-0.01, 0.02)
<i>P</i> value	0.07	0.12	0.78
Follow-up period			
Main adjusted model			
Difference relative to control (95% CI)	0.03 (0.01, 0.04)	0.05 (0.03, 0.06)	0.02 (0.0, 0.03)
<i>P</i> value	0.16	0.06	0.65
Fully adjusted model			
Difference relative to control (95% CI)	0.03 (0.01, 0.04)	0.05 (0.03, 0.06)	0.02 (0.0, 0.03)
<i>P</i> value	0.25	0.13	0.73

Abbreviations: CI, confidence interval

eTable 8. Adjusted differences in the proportion of participant-days step goals were achieved without multiple imputation

	Control	Gamification with Support	Gamification with Collaboration	Gamification with Competition	Gamification with Competition vs. Gamification with Support	Gamification with Competition vs. Gamification with Collaboration	Gamification with Support vs. Gamification with Collaboration
Main intervention period							
Proportion of participant-days step goal was achieved	0.25	0.39	0.38	0.43	-	-	-
Main adjusted model							
Difference relative to control and adjusted for baseline (95% CI)	-	0.14 (0.10, 0.18)	0.14 (0.10, 0.18)	0.18 (0.15, 0.23)	0.04 (0.0, 0.09)	0.05 (0.0, 0.09)	0.0 (-0.05, 0.05)
<i>P</i> value	-	<.001	<.001	<.001	0.03	0.048	0.79
Fully adjusted model							
Difference relative to control and adjusted for baseline (95% CI)	-	0.14 (0.10, 0.18)	0.14 (0.10, 0.18)	0.18 (0.15, 0.23)	0.04 (0.0, 0.09)	0.05 (0.0, 0.09)	0.0 (-0.05, 0.05)
<i>P</i> value	-	<.001	<.001	<.001	0.03	0.10	0.59
Follow-up period							
Proportion of participant-days step goal was achieved	0.23	0.29	0.26	0.32	-	-	-
Main adjusted model							
Difference relative to control and adjusted for baseline (95% CI)	-	0.07 (0.02, 0.12)	0.03 (-0.02, 0.08)	0.09 (0.04, 0.14)	0.02 (-0.03, 0.07)	0.05 (0.0, 0.10)	0.03 (-0.02, 0.08)
<i>P</i> value	-	0.05	0.17	0.002	0.27	0.10	0.59
Fully adjusted model							
Difference relative to control and adjusted for baseline (95% CI)	-	0.07 (0.02, 0.12)	0.03 (-0.02, 0.08)	0.09 (0.04, 0.14)	0.02 (-0.04, 0.07)	0.05 (0.0, 0.11)	0.03 (-0.02, 0.08)
<i>P</i> value	-	0.048	0.20	0.005	0.43	0.14	0.51

Abbreviations: CI, confidence interval

eTable 9. Adjusted differences in the proportion of participant-days step goals were achieved without multiple imputation and excluding step values < 1000

	Control	Gamification with Support	Gamification with Collaboration	Gamification with Competition	Gamification with Competition vs. Gamification with Support	Gamification with Competition vs. Gamification with Collaboration	Gamification with Support vs. Gamification with Collaboration
Main intervention period							
Proportion of participant-days step goal was achieved	0.26	0.40	0.40	0.44	-	-	-
Main adjusted model							
Difference relative to control and adjusted for baseline (95% CI)	-	0.14 (0.10, 0.19)	0.14 (0.10, 0.19)	0.19 (0.14, 0.22)	0.04 (0.0, 0.09)	0.04 (0.0, 0.09)	0.0 (-0.04, 0.05)
<i>P</i> value	-	<.001	<.001	<.001	0.03	0.08	0.69
Fully adjusted model							
Difference relative to control and adjusted for baseline (95% CI)	-	0.14 (0.10, 0.19)	0.14 (0.10, 0.19)	0.19 (0.14, 0.22)	0.04 (0.0, 0.09)	0.04 (0.0, 0.09)	0.0 (-0.04, 0.05)
<i>P</i> value	-	<.001	<.001	<.001	0.03	0.14	0.52
Follow-up period							
Proportion of participant-days step goal was achieved	0.24	0.31	0.28	0.33	-	-	-
Main adjusted model							
Difference relative to control and adjusted for baseline (95% CI)	-	0.06 (0.01, 0.11)	0.03 (-0.02, 0.08)	0.08 (0.03, 0.13)	0.02 (-0.04, 0.07)	0.05 (0.0, 0.10)	0.03 (-0.01, 0.09)
<i>P</i> value	-	0.06	0.15	0.004	0.34	0.17	0.68
Fully adjusted model							
Difference relative to control and adjusted for baseline (95% CI)	-	0.06 (0.01, 0.11)	0.03 (-0.02, 0.08)	0.08 (0.03, 0.13)	0.02 (-0.04, 0.07)	0.05 (0.0, 0.10)	0.03 (-0.01, 0.09)

<i>P</i> value	-	0.06	0.18	0.01	0.54	0.24	0.58
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Abbreviations: CI, confidence interval