

Supplement to Sepah et al. (2017), “Engagement and outcomes in a digital Diabetes Prevention Program: three-year update.” *BMJ Open Diabetes and Research Care*.

This Supplement contains additional analyses exploring the relationship between engagement and weight loss.

It is organized into four sections:

- Section A: A five-point statistical summary of engagement metrics during the three time windows of interest within the first year of the intervention (**Table S1**).
- Section B: Summary of correlations among engagement metrics, highlighting their overall similarity.
- Section C: Correlations between engagement metrics and weight change at different time points (**Table S2**).
- Section D: Definition of a composite engagement score, and an exploration of how that score differs among participants who were “successful” (weight loss $\geq 5\%$), “unsuccessful” (weight loss $< 5\%$), or “nonreporters” (those who failed to weigh-in) at each time point (**Table S3**).

Section A. Descriptive summary of individual engagement metrics

Table S1 summarizes program engagement across the 220 enrolled individuals, within the three time windows of interests (weeks 1–16, weeks 17–52, and weeks 1–52).

Table S1. Five-point percentile summary of engagement metrics.

Engagement Metric	Percentile				
	10th	25th	50th	75th	90th
During weeks 1–16					
Lessons Completed	2	8	16	16	16
Weight Tracked	6	10	14	16	16
Steps Tracked	0	2	12	12	12
Coach Conversations	1	3	6	12	20
Group Conversations	2	9	21	43.5	90.5
Group Posts Liked	0	0	0	4	18
Login Sessions	0	8	24	62	115
During weeks 17–52					
Lessons Completed	0	0	1	5	9
Weight Tracked	0	5	17	29	34
Steps Tracked	0	0	0	3	16.5
Group Conversations	0	0	4	14	47.5
Group Posts Liked	0	0	0	2	14
Login Sessions	0	0.5	11	41.5	126
During weeks 1–52					
Lessons Completed	2.5	8	17	21	25
Weight Tracked	7	18	31	44	50
Steps Tracked	0	2	12	15	28.5
Group Conversations	2	11	26.5	60	135
Group Posts Liked	0	0	1	9	34
Login Sessions	1	11	36	101.5	257

Section B. Simple correlations among individual engagement metrics

Within each time window (weeks 1–16, weeks 17–52, and weeks 1–52), individual engagement metrics were strongly correlated with one another (Spearman correlations: all r_s -values $\geq .382$, all p -values $< .000001$). In addition, engagement during weeks 1–16 was strongly correlated with engagement during weeks 17–52 for the six metrics that were computed in both time windows (all r_s -values $\geq .486$, all p -values $< .000001$).

Section C. Secondary analysis #1: Individual engagement metrics and correlations with weight change

Numerous prior DPP translations have explored the correlation of individual engagement metrics with weight change (see references [19–28] in the main text). **Table S2** (next page) presents Spearman correlations with between individual engagement metrics and 16-week, 1-year, 2-year, and 3-year weight change. During the first year, all examined correlations were negative, indicating that higher levels of engagement were associated with increased weight loss (i.e., negative values relative to baseline). By contrast, engagement during weeks 1–16, weeks 17–52, and/or weeks 1–52 was *not* associated with 2-year or 3-year weight change.

Table S2. Program engagement metrics and correlations with percentage weight change (% WC).

Engagement Metric	Spearman correlation with engagement metric: <i>r_s</i> -value (<i>p</i> -value)			
	with % WC at 16 weeks (<i>N</i> = 147)	with % WC at 1 year (<i>N</i> = 161)	with % WC at 2 years (<i>N</i> = 145)	with % WC at 3 years (<i>N</i> = 102)
During weeks 1–16				
Lessons Completed	-.402 (< .0001)	-.225 (.0040)	-.091 (.28)	.093 (.35)
Weight Tracked	-.347 (< .0001)	-.245 (.0018)	-.063 (.45)	.099 (.32)
Steps Tracked	-.355 (< .0001)	-.245 (.0018)	-.069 (.41)	.075 (.45)
Coach Conversations	-.375 (< .0001)	-.178 (.0237)	-.072 (.38)	.128 (.20)
Group Conversations	-.491 (< .0001)	-.245 (.0018)	-.032 (.70)	.082 (.41)
Group Posts Liked	-.384 (< .0001)	-.176 (.0256)	.039 (.64)	.077 (.44)
Login Sessions	-.559 (< .0001)	-.393 (< .0001)	-.129 (.12)	-.021 (.84)
During weeks 17–52				
Lessons Completed	—	-.373 (< .0001)	-.068 (.42)	.051 (.61)
Weight Tracked	—	-.301 (< .0001)	-.085 (.31)	-.022 (.83)
Steps Tracked	—	-.324 (< .0001)	.062 (.46)	.102 (.31)
Group Conversations	—	-.421 (< .0001)	-.078 (.35)	.014 (.89)
Group Posts Liked	—	-.307 (< .0001)	-.094 (.26)	-.049 (.62)
Login Sessions	—	-.445 (< .0001)	.022 (.79)	.131 (.19)
During weeks 1–52				
Lessons Completed	—	-.350 (< .0001)	-.059 (.48)	.069 (.49)
Weight Tracked	—	-.308 (.0001)	-.099 (.24)	-.021 (.84)
Steps Tracked	—	-.359 (< .0001)	.010 (.91)	.081 (.42)
Group Conversations	—	-.322 (< .0001)	.045 (.59)	.054 (.59)
Group Posts Liked	—	-.225 (.0040)	-.050 (.55)	.099 (.32)
Login Sessions	—	-.437 (< .0001)	-.125 (.13)	-.040 (.69)

Section D. Secondary analysis #2: Composite engagement scores and weight loss “success”

In order to explore the relationship between *overall* engagement and weight loss, a simple composite engagement score was defined for each participant during weeks 1–16, 17–52, and 1–52, as follows.

For each metric in each time window, an engagement threshold was determined: the value at which 50% (or as close to 50% as possible) of participants fell. Individuals at or above this threshold were deemed “more engaged” and coded as “1”; individuals below the threshold were deemed “less engaged” and coded as “0”. (For example, the engagement threshold for the “Weight Tracked” metric during weeks 1–16 was set at 15, because 48.2% of participants logged their weight at least once during 15 out of 16 weeks.) A participant’s *composite* engagement score for a given time window was then defined simply: the sum of “0s” and “1s” across the set of available metrics. A composite score of 4, for example, indicates that a participant was “more engaged” on any four of the individual engagement metrics.

Next, an analysis was performed to explore whether individuals “successful” at reducing their weight had higher composite engagement scores. Similar to previous studies (see Supplement references [1–4]), a participant was considered “successful” if weight loss from baseline was $\geq 5.0\%$, “unsuccessful” if weight loss was $< 5.0\%$, and a “nonreporter” if no weight data was available during that weigh-in window. (This three-level distinction enabled all 220 participants to be accounted for.) Weight loss success was evaluated at each time point (16 weeks, 1 year, 2 years, 3 years). Two-tailed, two-sample *t*-tests were performed to assess between-group differences among successful participants, unsuccessful participants, and nonreporters.

As summarized in **Table S3** (next page), composite engagement scores were significantly *higher* for participants who were successful (versus unsuccessful) in achieving $\geq 5\%$ weight loss at 16 weeks or 1 year, but not at 2 years or 3 years. Additionally, nonreporters had significantly *lower* composite engagement scores than both successful and unsuccessful participants at all weigh-in time points.

Table S3. Composite engagement scores as a function of weight loss (WL) success at each time point.

Weigh-in time point	Engagement time window	Composite engagement score (Mean \pm SE)			Two-sample <i>t</i> -test <i>p</i> -values		
		Nonreporters	Unsuccessful participants: WL < 5%	Successful participants: WL \geq 5%	Unsuccessful vs. Nonreporters	Successful vs. Nonreporters	Successful vs. Unsuccessful
16 weeks		(<i>N</i> = 73)	(<i>N</i> = 79)	(<i>N</i> = 68)			
	weeks 1–16 ^a	1.49 \pm .21	3.83 \pm .24	5.80 \pm .19	< .00001	< .00001	< .00001
	weeks 1–16 ^b	1.26 \pm .18	3.34 \pm .21	5.07 \pm .17	< .00001	< .00001	< .00001
1 year		(<i>N</i> = 59)	(<i>N</i> = 97)	(<i>N</i> = 64)			
	weeks 1–16 ^a	1.69 \pm .27	3.92 \pm .23	5.11 \pm .28	< .00001	< .00001	.0012
	weeks 1–16 ^b	1.38 \pm .23	3.41 \pm .23	4.50 \pm .24	< .00001	< .00001	.0006
	weeks 17–52	0.57 \pm .19	2.87 \pm .23	4.29 \pm .25	< .00001	< .00001	< .0001
	weeks 1–52	1.02 \pm .21	3.13 \pm .22	4.44 \pm .25	< .00001	< .00001	.0002
2 years		(<i>N</i> = 75)	(<i>N</i> = 92)	(<i>N</i> = 53)			
	weeks 1–16 ^a	2.35 \pm .29	4.05 \pm .25	4.87 \pm .28	< .00001	< .00001	.0391
	weeks 1–16 ^b	2.01 \pm .25	3.53 \pm .22	4.25 \pm .24	< .00001	< .00001	.0372
	weeks 17–52	1.33 \pm .25	3.29 \pm .25	3.47 \pm .30	< .00001	< .00001	.65
	weeks 1–52	1.60 \pm .24	3.55 \pm .24	3.79 \pm .28	< .00001	< .00001	.54
3 years		(<i>N</i> = 118)	(<i>N</i> = 65)	(<i>N</i> = 37)			
	weeks 1–16 ^a	2.65 \pm .23	5.01 \pm .26	4.54 \pm .36	< .00001	< .0001	.28
	weeks 1–16 ^b	2.30 \pm .20	4.32 \pm .23	4.00 \pm .31	< .00001	< .0001	.34
	weeks 17–52	1.65 \pm .20	4.11 \pm .26	3.38 \pm .39	< .00001	< .0001	.11
	weeks 1–52	1.95 \pm .20	4.32 \pm .24	3.70 \pm .36	< .00001	< .0001	.14

^a Composite score computed from all seven engagement metrics.

^b Composite score computed from six engagement metrics (excluding “Coach Conversations”) to enable direct comparison with composite scores for weeks 17–52 and 1–52 (which only had six engagement metrics available).

Supplement References

1. Tuomilehto J, Lindström J, Eriksson JG, Valle TT, Hämäläinen H, Ilanne-Parikka P, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med* 2001;**344**(18):1343–50.
2. Teixeira PJ, Going SB, Houtkooper LB, Cussler EC, Metcalfe LL, Blew RM, et al. Pretreatment predictors of attrition and successful weight management in women. *Int J Obes Relat Metab Disord*. 2004;**28**(9):1124–33.
3. Aziz Z, Absetz P, Oldroyd J, Pronk NP, Oldenburg B. A systematic review of real-world diabetes prevention programs: learnings from the last 15 years. *Implementation Science* 2015;**10**(1):172.
4. Painter S, Ditsch G, Ahmed R, Hanson NB, Kachin K, Berger J. Retrofit Weight-Loss Outcomes at 6, 12, and 24 Months and Characteristics of 12-Month High Performers: A Retrospective Analysis. *JMIR mHealth and uHealth* 2016;**4**(3):e101.