Weight Loss Effects of Digital Diabetes Prevention Programs: A Systematic Review

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BACKGROUND

Diabetes Prevention Programs (DPP) have proven effective for moderate weight loss and prevention of type 2 diabetes in at-risk individuals; and digital delivery modes provide accessibility of the programs to a broad population (2017 Systematic Review by [Bian] and colleagues.

OBJECTIVE

The objective of this systematic review is to update the prior review and explore effects of increased evolution of digital health technologies brought about by the COVID-19 pandemic and digital healthcare expansion.

Scan for References

METHODS

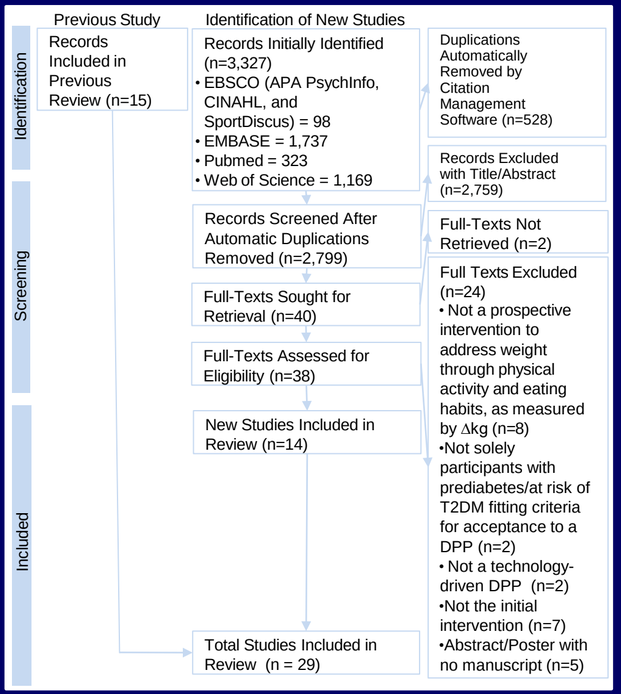
Two review tiers were conducted by one author.

Search Strategy:
- PubMed, CINAHL, APA Psych INFO, SportDiscus, EMBASE, Web of Science
- Publication through 11/11/2022
- Keywords: “digital” AND “weight loss” AND “diabetes prevention”; Filters: English, year, and adults

Inclusion Criteria:
- Prospective experimental design
- Technology-driven National Diabetes Prevention Program (DPP) or adapted intensive lifestyle intervention incorporating physical activity and dietary change
- Primary target outcome is weight loss

Exclusion Criteria:
- Conference abstracts/posters, letters to editors, case series, and case control studies
- Studies assessing environmental, economic, or administrative outcomes
- Participants with type 2 diabetes diagnosis
- Secondary/subgroup analyses

PRISMA TRIAL FLOW DIAGRAM



RESULTS

Table 1. Baseline Characteristics and Study Outcomes for New Studies

Study Cohort (Year) Intervention	Design	Sample, n	Age, years (SD)	% Female	% White	Weight, kg (SD)	BMI, kg/m2 (SD)	Attrition (%)	Level of Utilization	Mean Weight Change, kg (SD)	% Weight Change (SD)
Arens et. al. (2018) App + Online*	Prospective Observational Study	109	49.6 (9.3)	60.6	N/A	95.5 (18.0)	32.2 (5.5)	N/A	Time spent in program, up to 12 months: 3 months- 19.3%; 6 months- 32.1%; 9 months- 49.5%; 12 months- 79.8%	-2.40 (6.30)	-2.20 (6.80)
Betts et. al. (2017) Telephone*	Pre-Test/Post-Test Quasiexperimental	10	48.6 (13.1)	40.0	50.0	110.7 (18.6)	36.6 (10.2)	30	Engagement: conference calls, of 15- 9.2 (5.3); nutrition monitoring, of 20- 7.2 (6.4); activity monitoring, of 17- 6.5 (6)	-5.47 (8.98)	-4.90
Ciemins et. al. (2018) Telehealth 12-wk core	Prospective Cohort	198	51.8 (13.1)	86.4	N/A	104.1 (24.6)	37.4 (8.1)	34-37	Core sessions attended, of 12: 7.8 (3.2)	-3.70 (3.70)	-3.60 (3.30)
Everett et. al. (2018) AI-based App	Prospective Observational Study	43	57.2 (9.1)	63.0	71.0	90.3 (17.2)	32.6 (4.5)	86	N/A	-1.60 (2.50)	-1.90 (2.80)
Ferrara et. al. (2020) Online	RCT	80	51.8 (7.8)	73.8	23.8	87.7 (20.3)	31.8 (5.5)	N/A	Core sessions completed, of 16: 5.9 (CI 4.7,7.1)	-1.97	-2.41
Hepdurgun et. al. (2020) Online	RCT	51	40.1 (9.9)	80.4	N/A	87.7 (14.3)	32.2 (4.3)	21.6	Training videos completed: 25.4%	-2.28 (2.11)	N/A
Katula et. al. (2022) Online	RCT	299	55.3 (12.9)	61.5	91.3	101.8 (19.0)	35.8 (6.1)	19*	Weekly engagement: 54%	-5.52	-5.49
Lim et. al. (2022) App	RCT	72	51.9 (8.7)	40.3	N/A (79.2 Chinese)	82.7 (15.2)	29.8 (4.2)	6.9*	Utilization: median app usage- 97.8%; mean dietician chat through month 3- 3 days/wk; mean dietician chat in months 4 to 6- 2 days/wk	-4.20 (4.50)	-5.20 (5.40)
Moin et. al. (2018) Online	Nonrandomized Parallel Trail	268	60.3 (11.3)	30.6	71.3	98.5 (18.7)	32.6 (5.5)	9.7	Completion of sessions: 1 or more- 64.1%; 4 or more- 59%; 8 or more- 56%	-4.0	-3.70
Muralidharan et. al. (2019) App + Telephone	RCT	374	37.8 (9.2)	43.9	N/A	78.2	N/A	27.5	N/A	-1.10	N/A
Nosek et. al. (2019) Virtual Reality	Interrupted Time Series Quasiexperimental	24	49.6 (8.6)	100	69.0	81.8 (14.8)	31.7 (4.2)	32	Average engagement: in sessions, of 16- 12.46 (2.44); in days of lifestyle tracking, of 7- 4.92 (1.79)	-2.71	-3.31
Toro-Ramos et. al. (2020) App	RCT	101	55.7 (13.6)	73.8	N/A	85.7 (21.5)	31.3 (6.4)	22.3*	Average weekly engagement, over 12 months: in logged meals- 7.4 (8.03); in logged weights- 0.42 (0.83); in logged steps- 12,132 (14,131); in articles read- 3.92 (5.9); in group comments- 0.14 (0.32); in coach messages- 1.44 (1.91)	-3.31	-3.69
Wilson et. al. (2016) Telephone	RCT	106	47.8	67.9	40.6	95.4	33.6	41.8	N/A	-2.52	N/A
Wilson et. al. (2017) Online	Nonrandomized Trial with Matched Control	829	46.0	58.4	N/A	98.1	33.9	N/A	Average completion of more than half of curriculum lessons (>9 of 16) during intensive phase: 82.6%	-0.91	N/A

SD = standard deviation; AI = artificial intelligence; CI = confidence interval; RCT = randomized controlled trial
*Analyses included all participants, including those who did not finish the intervention

SUMMARY OF FINDINGS

- 29 studies met inclusion criteria; 15 from initial review, 14 newly identified (Table 1)
- 10 new studies were experimental trials, 7 of which were RCTs that demonstrated low to moderate risk of bias
- Methodological quality assessment of RCTs suggested that RCTs had low to moderate risk of bias
- 2,640 participants across the 14 new studies: mostly female, less likely to be racially or ethnically diverse, mean BMI =33.2
- Initial review studies’ interventions: telephone functionalities (2-4,9-12,14), online platforms (2,4-6,15), DVDs (1,5,8-9,12)
- New studies’ interventions: online platforms (16,20-22,24,29), mobile applications (16,19,23,25,27), telephone calls (17,25, 28), telehealth (video calling) (18), virtual reality (26), with addition of individual chat with dietician or virtual coaching sessions in those meeting target
- All intervention groups lost weight, with 6/29 total (6,9,12,13,22,23) and 2/14 new at or above the DPP goal weight loss of 5%
- Engagement, attrition, and type of intervention were not associated with a specific trend in weight change
- Limitations: retain/reject decisions were made by one researcher, varied study designs were included, and the non-RCT methods were not assessed using established quality assessment tools.

CONCLUSIONS

Digital DPP may increase access to target NDPP outcomes; programs that add individual coaching via on-demand chat functions and/or internet-based coaching sessions may help achieve weight loss and prevention goals. Future studies should intentionally recruit more diverse individuals to assess digital DPP effects in those population segments most at risk for diabetes.