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ORIGINAL ARTICLE

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A non-randomized comparison of engagement and outcomes for in-person versus virtual delivery of the Partner2Lose weight management trial

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Abstract

Objective: Existing behavioral weight management interventions produce clinically meaningful weight loss. The onset of the COVID-19 pandemic led to the quick transition of such interventions from in-person to virtual platforms. This provided a unique opportunity to compare engagement and outcomes for an in-person versus virtually delivered weight management intervention.

Methods: A non-randomized comparison of engagement and weight outcomes was performed between two cohorts who participated in a weight management intervention in person (N = 97) versus three who participated virtually via videoconference (N = 134). Various metrics of engagement were examined, including group

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class and individual phone call attendance and duration, and retention for weight assessments. Behavioral targets of daily caloric intake and step-counts and the clinical weight outcome were explored.

Results: Cohorts (mean [standard deviation] age 47.3 (11.5), 67.1% women: 86.8% White) that participated virtually attended more group sessions ($p < 0.001$) and had maintenance telephone calls that were of a longer duration ($p < 0.001$). No other engagement or weight outcomes significantly differed by delivery modality.

Conclusions: Virtual weight management programs are promising and may generate similar outcomes to those delivered in-person. Future research should seek to understand how best to promote and sustain engagement in virtual interventions.

KEYWORDS
COVID-19, engagement, videoconference, virtual intervention, weight loss intervention, weight management

1 | INTRODUCTION

Efficacious weight management programs involving didactic information and behavioral skills training help people lose weight and, to some extent, maintain weight loss over time.[1,2] Although these programs yield clinically significant (i.e., 5%) weight loss on average, there exists considerable variability in response,[3] which plausibly stems from a lack of consistent participant engagement among other possible factors. Engagement has been defined in many ways[4] and is associated with weight outcomes in weight management trials.[5,6] Engagement is defined here as carrying out an intervention task or activity. Identifying strategies to promote sustained engagement in weight loss interventions to achieve and maintain clinically significant weight loss remains an ongoing challenge.[3]

Historically, such interventions were conducted in person,[1–3] requiring participants to travel to and attend weekly or biweekly sessions over several months. The sudden onset of COVID-19 restrictions forced the Diabetes Prevention Program, Weight Watchers program, and research teams to quickly transition from in-person to remote delivery platforms such as phone calls, mobile health (mHealth) applications, and videoconferencing.[7–11] The problem of engagement for many behavioral weight-loss interventions was plausibly exacerbated by this recent transition from in-person to virtual delivery.

1.1 | The promise of remotely delivered interventions

The term "remote" often refers to any intervention not delivered in-person, including those delivered by telephone and virtually by videoconference. Remotely delivered interventions are promising for increasing the reach to individuals who struggle to access intensive in-person programs or find such programs burdensome or stressful.[12] They may also increase the engagement of underrepresented populations who identify with racial and ethnic minority groups, reside in rural areas, or are socioeconomically disadvantaged.[13,14]

Few direct comparisons of in-person versus remotely delivered weight management interventions exist. Weight-loss research before the COVID-19 pandemic indicated that engagement and weight loss outcomes are as good for telephone-based as for in-person interventions, particularly for adults residing in rural areas.[6,15] Although videoconference-based group intervention programs have demonstrated feasibility and the potential to improve health-related treatment outcomes,[16] they may be associated with decreased feelings of therapeutic alliance[17] and inadequately mimic in-person weight-loss programs. Although videoconferencing allows for real-time interactions, participants often turn off their cameras and can mute or walk away from the session entirely. Further, despite emerging evidence supporting enhanced engagement in virtual settings,[18] declines still occur over time.[4]

The few evaluations of videoconference-based interventions that emerged during the COVID-19 pandemic suggested generally promising but also mixed results for engagement.[19] Hu and colleagues[20] found in a 6-month mobile phone-based behavioral weight-loss trial that participants attended (i.e., logged into) videoconference-based counseling sessions 85.7% of the time. However, many turned off their cameras during the session, and adherence to app-based self-monitoring of dietary intake steadily declined over time, suggesting poor intervention engagement over time. Leahey et al. compared the adherence of pre-pandemic in-person sessions to post-pandemic videoconference sessions and found that treatment attendance was greater in the remote cohort, particularly among Hispanic populations.[10] However, other research showed reduced meeting attendance in weight-loss group meetings delivered over videoconference during the COVID-19 lockdown compared with in-person meetings pre-pandemic.[21]

Beyond engagement, research suggests that delivering weight-loss programs in-person or remotely may have no significant effect on weight loss or retention rates.[20] Yucel and Yucel,[22] however,

found that both phone-and video-counseling were more effective at promoting weight loss than traditional in-person group counseling sessions. Taken together, these findings suggest that further evidence is needed to understand the effectiveness of remotely delivered interventions in fostering sustained engagement and weight-loss maintenance.

1.2 | Present investigation

This investigation sought to determine how engagement and weight outcomes changed in an intervention that transitioned from in-person to virtual delivery at the onset of the COVID-19 pandemic. To do so, a non-randomized comparison of engagement between cohorts of participants who received a weight management intervention in-person or by videoconference was performed. Exploratory analyses were conducted on data from a randomized trial comparing a participant-only to a partner-assisted weight management intervention over 24 months.[3] During this time, participants experienced several life-changing events, including stay-at-home orders, indoor mask mandates, vaccine availability, return to work guidelines, and the proliferation of videoconferencing for personal, work, and educational activities. These unanticipated changes provided a rare opportunity for the research team to compare the engagement of individuals from the time when the weight loss portion of the intervention was delivered in-person to when it was delivered remotely over videoconference.

This research explores various indicators of engagement, including attendance at, and duration of, group classes and individual phone calls, and retention for weight assessments. The behavioral targets of daily caloric intake and step-counts as well as the primary outcome of weight over time are explored. Due to the mixed evidence concerning whether virtually delivered interventions promote or disrupt intervention engagement and weight outcomes, there were no a priori hypotheses.

2 | PARTICIPANTS

Community-dwelling index participants currently residing with a romantic partner in the greater Madison, WI metropolitan area were recruited into one of five cohorts ranging from 38 to 50 dyads each. Participants were enrolled in the study for 24 months (Figure S1). Study sample size calculations, recruitment strategies, and exclusion and inclusion criteria for participants and their partners have been described.[3] Briefly, index participants had either a body mass index (BMI) of 27 to 29.9 plus at least one obesity-related comorbidity or a BMI of at least 30 kg/m^2. Additionally, they had to live and have regular contact with a partner, speak English, be aged 18–74, and not have medical conditions that would contraindicate weight loss or affect weight. See Table 1 and Results for sample characteristics.

3 | MATERIALS AND METHODS

3.1 | Design

Partner2Lose[3] was a parallel, two-arm randomized controlled trial wherein participants were randomized with equal probability to either a participant-only or partner-assisted intervention. Across 24 months, index participants in both study arms were first enrolled in 6 months of weight-loss programming, then 12 months of weight-loss maintenance intervention, and finally 6 months of no-intervention contact. The romantic partners of participants assigned to the partner-assisted arm participated in half of the group classes and all phone calls, where the couples received additional instruction on and practice with communication skills. Partners of participants assigned to the participant-only arm did not take part in the intervention. Outcome assessments were collected every 6 months, with weight-loss at 24 months being the primary outcome.

3.1.1 | Key study details

The 6-month weight loss phase involved 13 group class sessions that met every other week. These classes were co-led by a registered dietician (RD) and an exercise physiologist, with 60–90 min focusing on nutrition education and behavioral strategies such as goal setting and mindfulness, and 15 min focusing on exercise education and demonstration.[3] The subsequent 12-month maintenance period involved: (i) 3 monthly group meetings and 3 monthly individual phone calls alternating every two weeks in months 7–9, followed by (ii) 3 monthly individual phone calls in months 10–12, and lastly (iii) 3 individual phone calls delivered every 2 months between months 13–18. All intervention content was consistent throughout the trial, regardless of delivery modality. In the first group session of each cohort, the principal investigator gave an overview of the study and emphasized the need to return for outcome assessments even if participants missed some or all of the intervention. The explanation was accompanied by an infographic demonstrating the potential bias associated with missing data, a strategy shown to be effective for increasing participant knowledge and trust.[23] One month prior to each outcome assessment, the study team mailed a letter to participants asking them to schedule their outcome assessment visit and included the same infographic to remind participants about the importance of outcome assessments.

3.1.2 | Pre and post COVID-19 protocol modifications

Important procedures and key changes made to the protocol in response to the 2020 COVID-19 stay-at-home orders are outlined here. Many details were kept consistent with the pre COVID-19 intervention plan,[3] with modifications focused on enabling effective

TABLE 1 Sample characteristics.

	Overall	In-person (Cohorts 1–2)	Virtual (Cohorts 3–5)
N	231	97	134
Date of first group session		12 March 2019	10 March 2020
Timing relative to COVID-19 onset		Pre COVID-19	Post COVID-19
Age (M(SD))	47.3 (11.5)	48.4 (11.6)	46.5 (11.5)
Race (%)[a]			
• White	198 (86.8%)	84 (88.4%)	114 (85.7%)
• Black or African American	8 (3.5%)	2 (2.1%)	6 (4.5%)
• Asian	12 (5.3%)	7 (7.4%)	5 (3.8%)
• American Indian or Alaskan native	3 (1.3%)	1 (1.1%)	2 (1.5%)
• Multiracial	7 (3.1%)	1 (1.1%)	6 (4.5%)
Hispanic/Latinx (%)	10 (4.3%)	3 (3.1%)	7 (5.2%)
Gender Identity (%)			
• Women	155 (67.1%)	61 (62.9%)	94 (70.1%)
• Men	74 (32.0%)	34 (35.1%)	40 (29.9%)
• Genderqueer	1 (0.45%)	1 (1.0%)	0 (0.0%)
• Multi-gender	1 (0.45%)	1 (1.0%)	0 (0.0%)
Employed full-time (%)[a]	176 (76.5%)	77 (79.4%)	99 (74.4%)
BMI kg/m2 (M(SD))	37.1 (6.4)	37.8 (7.3)	36.7 (5.8)
Weight kg (M(SD))	106.6 (19.4)	108.4 (20.7)	105.2 (18.4)
Caloric intake (kcal)	2143 (733.4)	2088 (781)	2182 (698)
Step count	8114 (3513)	7998 (3397)	8209 (3616)

[a]221 participants reported their race, and 230 participants reported their employment status.

virtual delivery of the intervention. The most significant change from the original Partner2Lose protocol was that all cohorts transitioned to remote intervention procedures at various points in the study (Figure S1). Cohort 1 completed all 16 group-based classes in-person at a community location.[3] Cohort 2 completed the 13 weight loss classes in person and then had three maintenance group sessions by videoconference. These two cohorts were combined into an "in-person intervention delivery" group. Cohort 3 had one class in person and then transitioned to videoconference, and Cohorts 4 and 5 completed the entire group-based intervention remotely. These three cohorts were combined into a "virtual intervention delivery" group (Table 1). The decision to combine Cohorts 1 and 2 into an "in-person intervention delivery" group and Cohorts 3, 4, and 5 into a "virtual intervention delivery" group was made based on the primary delivery modality of the 13 weight-loss-focused group classes. Both Cohorts 1 and 2 attended all weight loss group classes in person, and Cohorts 3, 4, and 5 attended all weight loss group classes virtually except for the first class in Cohort 3. Participants in Cohorts 1, 2, and 3 received exercise bands and Fitbit activity trackers at in-person baseline visits; Cohorts 4 and 5 received them by mail. All cohorts were mailed digital bathroom scales after the pandemic began because in-person outcome assessments were prohibited for several months during 2020.

Exercises for all cohorts were meant to be completed at home without equipment, except for a few that required exercise bands provided by the study team. The pre COVID-19 in-person cohorts (1–2) participated in 15 min of exercise education followed by exercise physiologist-led demonstrations. For the post COVID-19 virtual cohorts (3–5), the study team recorded videos of the exercise physiologist demonstrating exercises at the standard level, with a separate window depicting a study team member demonstrating modified, stepped-down versions of the exercises that could be performed while seated in a chair. These videos were closed captioned and included content markers to promote greater accessibility. They were shown during the virtual classes.

3.1.3 | Measures

Data on participant engagement, captured in Research Electronic Data Capture (REDCap) surveys,[24,25] included attendance in 13 weight-loss group meetings during the 6-month weight-loss phase, attendance in three monthly group sessions and nine telephone calls during the 12-month maintenance phase, and completion of primary outcome assessments every 6 months across the 24-month study period.

The behavioral targets of dietary intake and physical activity were captured every 6 months. Self-reported dietary intake was collected using the ASA-24.[26] This measure is analyzed using proprietary algorithms to estimate daily macronutrient and micronutrient intake. Participants were prompted by e-mail to complete one survey on a weekday and one on a weekend day within a 7-day window at each 6-month assessment period. A video created by the team demonstrated how to enter data into the software. Daily steps were recorded with a Fitbit activity tracker. Participants were asked to wear them daily for 7 days during each 6-month assessment period.[3]

The original protocol required participants to attend an in-person assessment where they stepped on a study scale and completed surveys on a tablet. During the stay-at-home order in 2020, all cohorts were asked to complete outcome assessments at home. Each member of the couple was sent a link to a REDCap survey and instructed to manually type in their weight and then upload a photo of their weight displayed on the study-provided scale. A member of the study team compared the uploaded photo to the weight typed into the REDCap survey. For one outcome assessment period in late 2020, after the stay-at-home order was lifted, participants were asked to complete an outdoor drive-by visit where they stepped on the study scale and to weigh at home using the previously described method on the same day (Figure S2). In September 2021, the study resumed in-person assessments and offered remote assessments for participants who were unwilling to attend in-person. Participants were paid $40 for outcome assessments at 6, 12, and 18 months. Cohorts 1–4 were paid $60 for month 24, and this incentive was increased to $70 for Cohort 5 to boost retention. All procedures described here were approved by the institutional review board (protocol #2018-1400).

3.1.4 | Data preparation and analysis

Results of the main study outcomes and details on adverse events (in partner and participant-only arms: 3% and 4% were serious, 3% and 1% expected, 0% and 0% probably or definitely related, respectively) will be described in a separate paper. The purpose of the current examination was to compare participant engagement in the Partner2Lose intervention before and after the onset of the COVID-19 pandemic when participants transitioned from in-person to virtually delivered intervention.

As there were no differences in primary and secondary outcomes between the participant-only and partner-assisted intervention arms, data were collapsed across arms for the present exploratory analyses comparing in-person to virtual groups. Exploratory descriptive and inferential data analyses were performed on measures of engagement, behavioral targets, and weight. Data were summarized via mean (standard deviation [SD]), median (interquartile range [IQR]), or *N* (%) where appropriate. Demographic and patient characteristics were compared using *t*-tests or chi-square tests. Wilcoxon rank sum tests were performed on the attendance data, and repeated measures analyses were conducted to assess changes in the behavioral targets and weight outcome over time. Covariates were not included because demographic variables were relatively balanced (Table 1). Due to the exploratory nature of the analyses, an unadjusted 5% significance level was used for all tests. Analyses were performed using R for statistical computing version 4.3.

4 | RESULTS

4.1 | Sample characteristics

Details on participant enrollment, allocation, and retention are depicted in Figure S3. Across cohorts, there were 231 index participants with mean (SD) age 47.3 (11.5), who self-identified as 67.1% women, 32.0% men, 0.9% other gender, 86.8% White, 3.5% Black or African American, 5.3% Asian, 1.3% American Indian or Alaskan Native, 3.1% Multiracial, and 4.3% Hispanic/Latinx. Additional information on participant characteristics and baseline equivalency of in-person and virtual cohorts is outlined in Table 1.

4.2 | Engagement measures

Group session attendance was significantly lower for in-person cohorts (Median [IQR] = 11.0 [5.0–14.0] visits) compared to virtual cohorts (13.0 [10.0–15] visits; $W = 4603.5$, $p < 0.001$, $d = 0.25$, 95% confidence interval (CI) [−3.0, −1.0]) (Figure 1). However, the duration of in-person classes ($M = 73.4$, SD = 11.6 min) was similar to virtual classes ($M = 65.9$, SD = 14.2 min), $t = 1.12$, $p = 0.28$, $d = 0.37$, 95% CI [−4.8, 15.3]. The mean number of maintenance calls attended was nearly identical when comparing the in-person (Median [IQR]: 9.0 [6.0–9.0] visits) and virtual cohorts (8.0 [6.0–9.0] visits; $W = 4114.5$, $p = 0.32$, $d = 0.08$, 95% CI [0, 0]) (Figure S4). However, the call duration was longer for cohorts who attended the group sessions virtually ($M = 29.8$, SD = 11.3 min) than in-person ($M = 22.3$, SD = 9.1 min), $t = -8.35$, $d = 0.82$, 95% CI [−9.6, −5.9].

A steep decline was observed in retention for primary outcome assessments in both the in-person and virtual groups. Provision of weight data dropped from 100% at baseline to 72.2% in the in-person cohorts and 76.1% in the virtual cohorts at 24 months, with no differences at 6 months ($x^2 = 0.28$, $p = 0.60$, $w = 0.04$), 12 months ($x^2 = 0.00$, $p = 0.99$, $w = 0.00$), 18 months ($x^2 = 0.00$, $p = 0.99$, $w = 0.00$), or 24 months ($x^2 = 0.28$, $p = 0.60$, $w = 0.04$) (Figure 2).

4.3 | Behavioral targets

At 6-month intervals across the 24-month intervention, there were nearly identical patterns for in-person and virtual cohorts (Figure 3) in change for average daily caloric intake (kcal) at 6 months

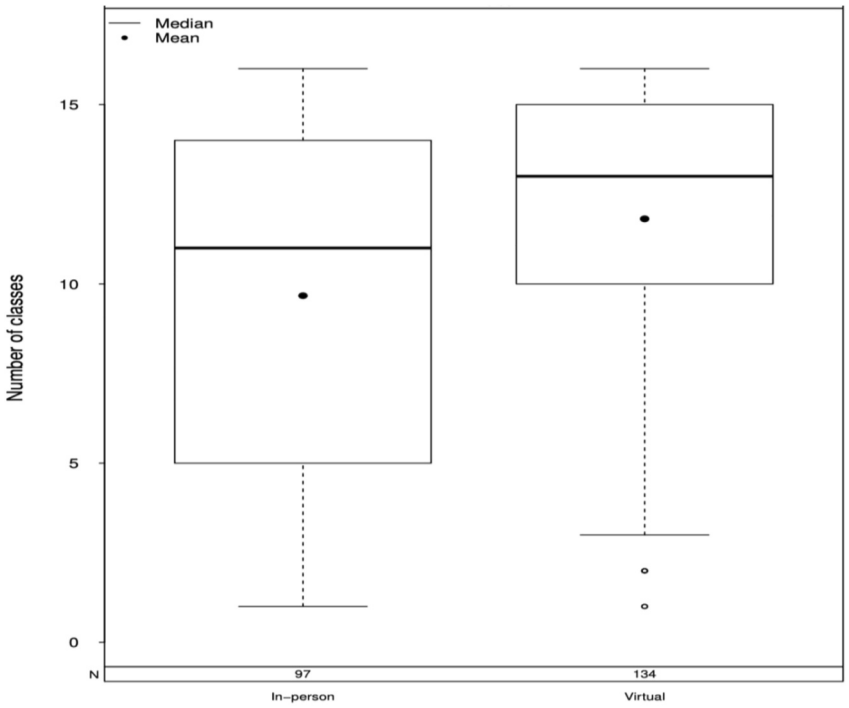


FIGURE 1 Average number of group classes attended (out of 16) for in-person versus virtual cohorts. Box and whisker plots indicate the median (solid line), mean (dot), and interquartile range within the dimensions of the boxes.

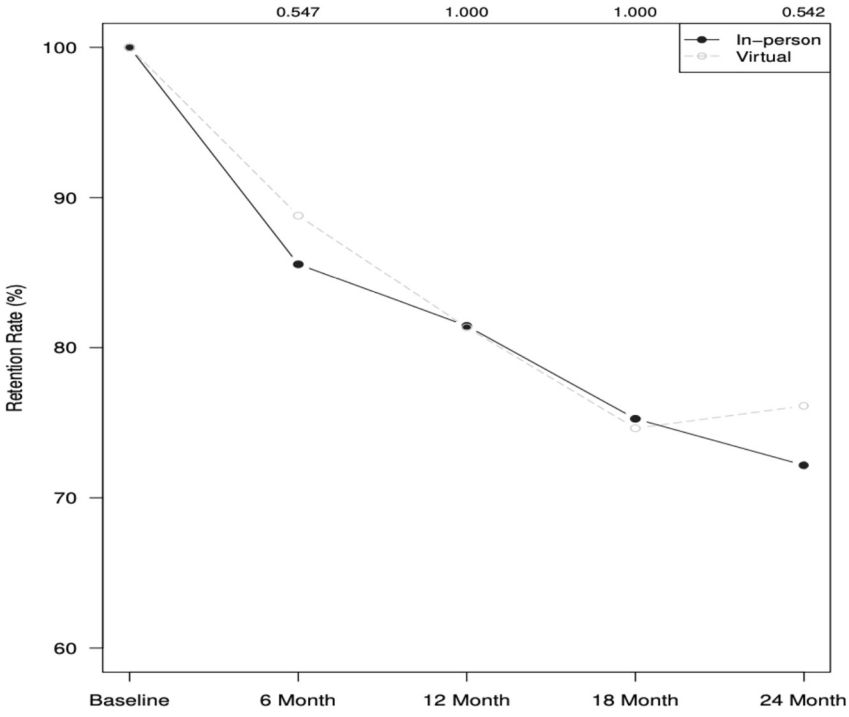
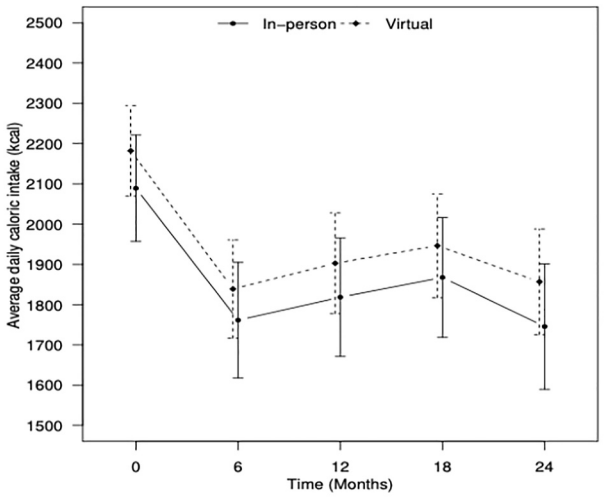


FIGURE 2 Retention of weight data over time for in-person and virtual cohorts.

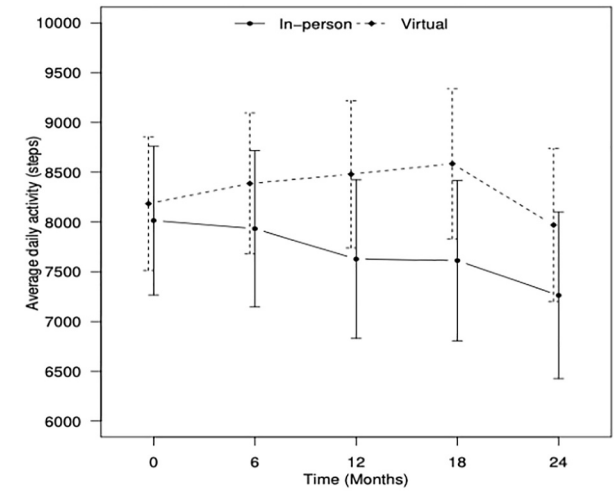
(t = 0.16, p = 0.87, d = 0.01, 95% CI[−176,208]), 12 months (t = 0.10, p = 0.93, d = 0.01, 95% CI[−187,205]), 18 months [t = 0.14, p = 0.89, d = 0.01, 95% CI [−186,214]), and 24 months (t = −0.17, p = 0.86, d = −0.013, 95% CI [−225, 188]). The same was true for average daily step counts at 6 months (t = −0.69, p = 0.49, d = 0.06, 95% CI [−1095,525]), 12 months (t = −1.58, p = 0.11, d = 0.13, 95% CI [−1530,165]), 18 months (t = −1.82, p = 0.07, d = 0.15, 95% CI [−1672, 66]), and 24 months (t = −1.16, p = 0.25, d = 0.10, 95% CI [−1446, 373]).

4.4 | Weight

The pattern of change in participant weight was similar for the in-person and virtual cohorts (Figure 4) at 6 months (t = 0.81, p = 0.42, d = 0.06, 95% CI [−1.0, 2.5]), 12 months (t = −0.15, p = 0.88, d = 0.01, 95% CI [−2.0, 1.7]), 18 months (t = −0.75, p = 0.45, d = 0.06, 95% CI [−2.6, 1.1]), and 24 months (t = −0.42, p = 0.68, d = 0.03, 95% CI [−2.3, 1.5]), suggesting no major difference by intervention delivery modality.

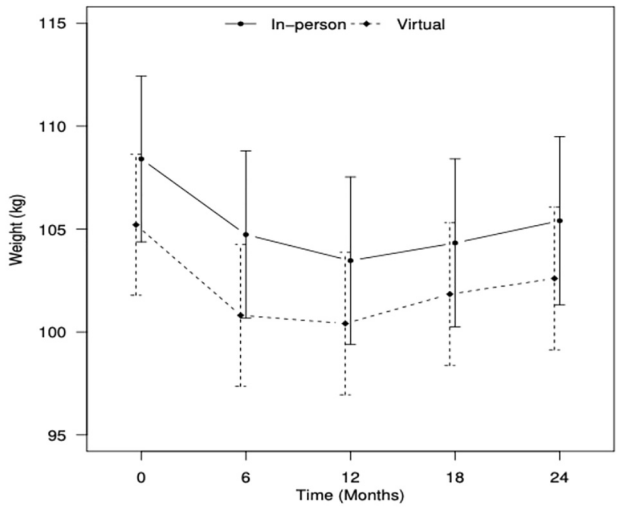


In–person: N	96	77	72	70	61
Virtual: N	134	106	99	91	87
In–person Mean (95% CI)	2089.0 (1956.9, 2221.1)	1761.4 (1617.5, 1905.2)	1818.4 (1671.1, 1965.7)	1867.5 (1718.7, 2016.2)	1745.5 (1589.5, 1901.5)
Virtual Mean (95% CI)	2182.1 (2070.1, 2294.1)	1838.8 (1716.6, 1961.0)	1902.7 (1777.5, 2027.9)	1946.2 (1817.1, 2075.2)	1856.8 (1725.7, 1987.9)
Δ of Δ from 0 mo.	NA	15.7 (−176.0, 207.5)	8.8 (−187.4, 205.1)	14.4 (−185.5, 214.3)	−18.2 (−224.6, 188.3)
P–value	NA	0.872	0.930	0.887	0.863



In–person: N	93	75	70	66	55
Virtual: N	115	90	74	68	63
In–person Mean (95% CI)	8014 (7267, 8761)	7932 (7148, 8717)	7627 (6831, 8423)	7613 (6807, 8418)	7263 (6426, 8100)
Virtual Mean (95% CI)	8183 (7514, 8853)	8387 (7678, 9095)	8479 (7739, 9219)	8585 (7831, 9339)	7969 (7202, 8737)
Δ of Δ from 0 mo.	NA	−285 (−1095, 525)	−682 (−1530, 165)	−803 (−1672, 66)	−536 (−1446, 373)
P–value	NA	0.490	0.114	0.070	0.247

FIGURE 3 Estimated daily caloric intake and daily steps for in-person versus virtual cohorts.



In–person: N	97	83	79	73	70
Virtual: N	134	119	109	100	102
In–person Mean (95% CI)	108.4 (104.4, 112.4)	104.7 (100.7, 108.8)	103.5 (99.4, 107.5)	104.3 (100.2, 108.4)	105.4 (101.3, 109.5)
Virtual Mean (95% CI)	105.2 (101.8, 108.6)	100.8 (97.4, 104.3)	100.4 (97.0, 103.9)	101.8 (98.4, 105.3)	102.6 (99.1, 106.1)
Δ of Δ from 0 mo.	NA	0.7 (−1.0, 2.5)	−0.1 (−2.0, 1.7)	−0.7 (−2.6, 1.1)	−0.4 (−2.3, 1.5)
P–value	NA	0.421	0.878	0.453	0.677

FIGURE 4 Observed weight across time for in-person versus virtual cohorts.

5 | DISCUSSION

Exploratory results of the Partner2Lose trial suggest similar patterns of engagement with the intervention and related behavioral targets, as well as weight, for in-person and virtually attended group sessions. The exceptions were significantly greater attendance at group sessions and longer maintenance call duration among cohorts that participated virtually due to COVID-19. These increases did not translate to improved health behaviors or weight loss.

This boost in attendance in the videoconference relative to the in-person sessions is consistent with the patterns of attendance reported by Hu and colleagues[20] and Leahey and colleagues.[10] There are several plausible explanations for why attendance may have increased in the virtual cohorts relative to the in-person cohorts. Participants in the virtual cohorts attended group sessions following the onset of COVID-19, and the stay-at-home orders and shifts in daily routines likely led participants to experience feelings of social isolation,[27] negative emotions like boredom and sadness,[28] to recognize weight gain,[29] and to shift daily activities toward more sedentary behaviors.[30] These factors may have increased the appeal of attending virtual sessions during the height of the pandemic. The change in daily routines (including a transition for some to remote work) may also have reduced transportation barriers as participants no longer needed to travel (including in inclement weather) to attend sessions in-person. The use of videoconference technology also provided a platform on which participants could safely interact with others.

Although patterns of engagement in phone call attendance and retention of weight data, key behavioral targets, and the longer-term clinical weight outcome were similar for in-person and virtual cohorts, engagement still declined in all cohorts over time. Declines in attendance and adherence to behavioral targets are common in weight loss studies. Financial incentives have been shown to increase adherence[31,32]; however, financial incentives for session attendance or for meeting behavioral targets were not provided in this study. Participants were incentivized for providing weight outcome data.

When retention for the primary end point was below the prespecified target of 80% for the first four cohorts, the team increased the incentive for Cohort 5. However, even with additional financial incentives and education about the importance of providing outcomes, the loss to follow-up could not be overcome because Cohort 5 had a smaller sample size. This suggests a need for involving community advisory boards and facilitating ongoing community engagement to better identify retention strategies beyond financial incentives for outcome assessments.[32] Future research should also replicate and extend these findings to better evaluate their generalizability to more diverse populations and intervention settings.

Finally, digital engagement is a multifaceted construct that involves the simultaneous investment of affective, cognitive, and physical energies (e.g., emotions, attention, information processing, actions) directed toward a specific task or activity.[4] This can be distinguished from adherence, defined as participants following specific instructions to complete a task (e.g., logging into a virtual session).[4] Adherence behaviors may be necessary, but not sufficient, to sustain engagement over time. Existing research often conflates these concepts and defines both engagement and adherence based on low-investment behaviors such as clicking on a link, attending a videoconference session, or opening a smartphone application, without requiring additional emotional or attentional investment. Indeed, the maintenance of engagement over time likely involves investment beyond mere adherence.

The present examination has some limitations. As participants' emotional and cognitive investment was not measured, it is not possible to precisely distinguish these concepts in the engagement measure that was collected, namely attendance. Further, behavioral proxies of engagement that reflect investment were not recorded, such as whether participants turned their videos on, unmuted to speak during sessions, and/or sent messages through chat windows. Measuring these behaviors would have provided more in-depth information regarding participant engagement during the sessions and represents a direction for future research. As this was a nonrandomized comparison, causal arguments cannot be made. Moreover, there is a potential for confounding by unmeasured factors, and the unique circumstances participants faced during COVID-19 may reduce generalizability of the findings. Finally, although most weight loss sessions were virtual in Cohort 3, the first session was in-person; thus, this cohort did not experience the entire weight loss component of the intervention virtually.

These limitations are countered by several strengths. Data were systematically collected on attendance, and participants were provided with several options to provide outcomes to accommodate individual differences in comfort. Intervention fidelity was also assessed throughout the trial duration through review by doctoral trained investigators of 75% of group classes and 10% of telephone calls using fidelity checklists.

This research provides a foundational step in examining participant engagement with in-person versus virtually delivered weight maintenance interventions and brings to light the importance of studying engagement in different ways to understand its impact more precisely. Although virtual weight management programs are promising and may generate similar outcomes to those delivered in-person, more work is necessary to understand how best to promote engagement in these interventions. Given that engagement is associated with better outcomes in multiple studies,[5,6] future research should determine how to conceptualize and measure varying levels of engagement with the goals of (i) effectively promoting and sustaining engagement across time and intervention components and (ii) having a clinically meaningful impact on weight outcomes. Future research should also identify strategies that promote and sustain engagement and determine which aspects of engagement are predictive of enhanced clinical outcomes. Such research will improve both the effectiveness and accessibility of weight maintenance programs.

AUTHOR CONTRIBUTIONS

All authors were involved in the writing of the paper, with Stephanie M. Carpenter, Armaan Shetty, and Corrine I. Voils writing the original draft, and Laura S. Porter, Kristen E. Gray, Ryan J. Shaw, Megan A. Lewis, Heather M. Johnson, Samantha Pabich, William S. Yancy Jr., Katya Garza, Felix Elwert, Lu Mao, and Scott J. Hetzel reviewing and providing critical edits. Corrine I. Voils, Laura S. Porter, Kristen E. Gray, Ryan J. Shaw, Megan A. Lewis, Heather M. Johnson, Samantha Pabich, and William S. Yancy Jr conceived and designed the experiments. Armaan Shetty, Katya Garza, and Samantha Pabich performed the experiments. Scott J. Hetzel, Felix Elwert, Lu Mao, Corrine I. Voils, and Stephanie M. Carpenter were involved in analyzing and interpreting the data, with Scott J. Hetzel conducting formal analyses. Felix Elwert, Lu Mao, and Corrine I. Voils contributed materials and analysis tools.

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CONFLICT OF INTEREST STATEMENT

Samantha Pabich is a Consultant for Eli Lilly and Company, and a Consultant for Dynamed. Ryan Shaw is a Consultant for Cerner Enviza. No other authors declare any interests.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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