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Eight-Month Follow-Up of Physical Activity and Central Adiposity: Results From an Internet-Delivered Randomized Control Trial Intervention

Lucas J. Carr, R. Todd Bartee, Chris M. Dorozynski, James F. Broomfield, Marci L. Smith, and Derek T. Smith

Carr, Bartee, Dorozynski, Smith, and Smith are with the Division of Kinesiology and Health, University of Wyoming. Broomfield is with the College of Health Sciences, University of Wyoming.

Abstract

Background—Less than half of U.S. adults engage in the recommended amount of physical activity (PA). Internet-delivered PA programs increase short-term PA but long-term adherence is largely equivocal.

Purpose—To determine whether increased PA following the 16-week internet-delivered Active Living Every Day (ALED-I) program is maintained 8 months later in sedentary and overweight rural adults.

Methods—In our previous randomized controlled trial (N = 32; 18 intent-to-treat controls, 14 ALED-I interventions), the ALED-I group increased PA (+1384 steps/day; E.S. = 0.95) and reduced central adiposity. Nine original intervention participants and ten delayed intent-to-treat control participants completed ALED-I and an 8-month follow-up. Pedometer-measured PA, anthropometric variables, and cardiometabolic disease risk factors were assessed at baseline, postintervention, and at 8 months.

Results—Control crossover participants increased PA (+1337 steps/day; $P = .04$). Eight months following completion of ALED-I (N = 19), PA levels relapsed (−1340 steps/day) and were similar to levels before the intervention (6850 ± 471 steps/day vs. 6755 ± 543 steps/day; $P = .89$). Total cholesterol and triglycerides improved, −9.9% and −18.2%, respectively, and reductions in central adiposity were maintained (97.1 ± 2.2 cm vs. 97.2 ± 2.2 cm; $P = .66$).

Conclusions—The ALED-I intervention was efficacious in the short-term but did not produce longer-term adherence to PA. Future theory-based internet-delivered interventions that produce habituation of increased PA are warranted.

Keywords

adherence; cardiometabolic; overweight; pedometer; physical activity; sedentary

Increasing the amount of daily physical activity (PA) among the adult population in the United States is a public health priority.¹ Current adult PA recommendations have been well established at 30 minutes or more of moderate-intensity PA on most, if not all, days of the week.^{2,3} This daily amount of PA can be accumulated in 10 to 15 minute bouts throughout the course of the day and can be part of a habitually active lifestyle as an alternative to a more structured daily exercise program.¹ Still, less than half (48.1%) of U.S. adults are achieving the minimal recommendations.⁴

The benefits of a habitual, physically active lifestyle are prolific, including decreased cardiometabolic disease risk,⁵ prevention of weight gain,⁶ and overall maintenance of quality

of life.⁷ The Task Force on Community Preventive Services (2002) recommends individually adapted behavior change programs for increasing PA in communities.⁴ The internet has been suggested as a possible community delivery medium due to its broad reach, cost-containment potential, and growing accessibility.^{8,9} Recent efforts have heeded this call and approximately 50% of internet-delivered PA interventions have shown short-term increases in self-reported PA.¹⁰ While the adoption of short-term changes in PA behaviors with internet-delivered interventions is promising, interventions that promote not only immediate adoption of, but also long-term adherence to a habitually active lifestyle are largely unreported.

Adherence to a habitual, physically active lifestyle requires both initial adoption of the new behavior as well as maintenance of the behavior. Long-term maintenance of PA is seldom studied and difficult to achieve.¹⁰⁻¹³ Evidence demonstrating success of long-term adherence to PA as a result of interventions is minimal,¹⁴ and long-term compliance to structured exercise programs is negligible.¹⁵ Differences between the mediating factors for PA adoption and those that contribute to adherence to PA may partly account for the lack of longer-term efficacy.¹³

The current study tracked participants 8 months after completion of the 16-week internet-delivered Active Living Every Day (ALED-I) PA behavior change program. Short-term results from the ALED-I intervention have been reported as part of a previous randomized control trial.¹⁶ The ALED-I program is commercially available (Human Kinetics) and theory-based (Transtheoretical Model and Social Cognitive Theory). It was originally developed for delivery in small group, classroom-like formats.¹⁷ This classroom-delivery format has shown significant improvements in both self-reported PA^{18,19} and aerobic fitness.^{20,21} We recently demonstrated that internet delivery (ALED-I) increased PA, reduced central adiposity, and improved coronary risk ratio (CRR).¹⁶ Therefore, the aim of the current study was to determine whether improvements in PA and cardiometabolic disease risk factors following completion of the 16-week ALED-I program were maintained 8 months later in middle-aged, sedentary, overweight/obese, rural adults. We hypothesized that participants who completed the 16-week ALED-I intervention would achieve a tempered maintenance of PA levels and cardiometabolic disease risk factors at the 8-month follow-up.

Methods

Experimental Approach to the Problem

The reader is referred to Carr et al¹⁶ for a more thorough description of the initial randomized controlled trial measures from which this follow-up study evolved. Briefly, qualified participants were randomized to either the ALED-I intervention group (N = 14) or a delayed intent-to-treat control group (N = 18). Following baseline testing, ALED-I participants were provided access to the ALED-I Web site along with the ALED workbook¹⁷ and instructed to complete the 16-week program at their chosen pace. Contact between ALED-I participants and facilitators was limited to weekly e-mail/phone contact for the first two weeks with e-mail contact every other week thereafter. The ALED-I Web site content and functionality¹⁷ are designed to increase daily PA by guiding participants through the self-paced program through the use of interactive activities and behavior modification strategies.

Eight-Month Follow-Up Participants

Following completion of the original study's 16-week experimental period, the delayed intent-to-treat participants (control condition) were given the option to crossover and receive the 16-week ALED-I intervention exactly as participants originally randomized to the intervention had received. All participants who completed the ALED-I intervention were given the option to also participate in a follow-up testing session 8 months after their active 16-week ALED-I intervention responsibilities were completed. Of the original 14 intervention and 18 delayed

intent-to-treat control participants who completed the ALED-I intervention, 19 participants elected to participate in the 8-month follow-up session (9 and 10 participants, respectively; Figure 1). Eight of the intent-to-treat controls who subsequently completed the ALED-I intervention and five of the original intervention participants chose not to participate in the follow-up session for various reasons (Figure 1). The follow-up testing session was completed for each participant exactly 8 months following completion of the ALED-I intervention regardless of original group randomization, thus participants initially randomized to the ALED-I intervention group completed the 8-month follow-up roughly four months earlier than the intent-to-treat control participants due to the initial 16-week control period. The participants ($N = 19$) for the current study were 74% female, and due to the consistent inclusion criteria emanating from the original study, similar in baseline descriptive and anthropometric characteristics when compared with participants from the original randomized control trial and to the 13 participants who elected not to participate in the 8-month follow-up session. Respectively, completers of the 8-month follow-up compared with noncompleters were similar in age (46.9 ± 2.4 vs. 46.1 ± 3.3 years; $P = .96$), physical activity (6755 ± 471 vs. 6887 ± 715 steps/day; $P = .87$), body mass index (BMI) (31.4 ± 1.0 vs. 31.1 ± 1.1 kg/m²; $P = .9$), systolic blood pressure ($P = .41$), diastolic blood pressure ($P = .09$), and fasting lipid/lipoprotein, glucose, and insulin concentrations. These descriptive data for the 8-month follow-up volunteers (completers and noncompleters) are not statistically different from the original randomized control trial cohort.

Participants were provided access to the ALED-I Web site for the 8 months following their formal completion of the ALED-I intervention. However, aside from the contact required to schedule the 8-month follow-up, participants had no contact with the investigative team. The 8-month follow-up testing session was conducted at the research laboratory on the University of Wyoming campus in Laramie, WY. All measures (following) from the original study were repeated by the same trained investigators according to the previously described procedures.¹⁶

Measures for Original Randomized Controlled Trial

One week before baseline testing and during week 16 of the intervention, PA was measured by pedometer (Yamax Digiwalker SW-200, Lee's Summit, MO). Body mass was measured to the nearest 0.1 kg and height to the nearest 0.5 cm using a calibrated medical balance beam scale (Detecto, Webb City, MO). BMI was calculated as weight (kg) divided by height (m) squared. Waist circumference was measured in duplicate with a standard Gulick measuring tape according to standard procedures.²² Percentage body fat and lean body mass were determined by dual energy X-ray absorptiometry (DEXA; Lunar Prodigy Dual Energy, GE Healthcare Lunar Company, Madison, WI). Venous blood was collected according to standard phlebotomy techniques following an overnight fast (~10 hours) with the exception of water consumption. An infection/inflammation questionnaire assessed underlying acute illness/infection, and 20 mL of blood was collected between 6:00 to 9:00 AM into two vacutainer tubes containing either 0.081 mL 15% (K3) EDTA solution or clot activator. Samples were centrifuged, aliquoted, and frozen at -70°C until biochemical analyses. Fasting serum lipid/lipoprotein, glucose, insulin, and C-Reactive Protein concentrations were determined by an outside clinical laboratory (Lab-Corp, Denver, CO). Coronary Risk Ratio (CRR) was calculated according to the equation, Total Cholesterol (mg/dL)/HDL (mg/dL). Insulin sensitivity and resistance were estimated using the inversely correlated homeostasis model assessment (HOMA-IR) and the quantitative insulin sensitivity check index (QUICKI).^{23,24} For women, age, systolic blood pressure, total cholesterol, high density lipoprotein, and systemic concentration of C-Reactive Protein were entered into a cardiovascular algorithm (Model B, Reynolds Risk Score) to calculate the cardiovascular risk score,²⁵ which has only been validated in women. Participants completed a timed, supervised, submaximal one-mile

walk test on a premeasured indoor track while wearing a heart rate monitor (Polar 600i, Polar USA) according to previously validated procedures.²⁶ Subsequently, aerobic fitness was estimated according to gender-specific prediction equations of Kline et al.²⁶ The aforementioned measures were collected and are reported at baseline, postintervention, and 8 months for this follow-up study.

Procedures Specific to the 8-Month Follow-Up

Participants were allowed to keep their pedometers at completion of the intervention but no instruction or suggestion to keep using the pedometers was given. Eight months after completion of the intervention, participants were mailed instructions with a step log and another pedometer and asked to record daily steps for seven consecutive days. This procedure is identical to that previously employed for participants completing the 16-week ALED-I intervention.¹⁶ Step logs were returned at the time of each participant's follow-up testing session. Step data were only included if at least three out of the seven days of pedometer recording was completed to remain consistent with our previous procedures.²⁷ Out of a possible 133 recording days, the 19 participants reported 132 days (99.3%).

All metabolic measures were measured by the same clinical laboratory as previously described. Reynolds risk score²⁵ was calculated for the 14 women in the study who completed the 8-month follow-up.^{16,25} Compliance measures during the 16-week ALED-I intervention included a minimum number of unique journal activities completed and a minimum number of unique dates each participant logged in and completed an online activity. Participants were also asked to complete an 8-month maintenance survey which addressed each participant's personal use of the Web site, workbook, and pedometer. An indicator of pedometer-measured baseline PA behavior was determined according to previous recommendations by Tudor-Locke et al.²⁸ that stratified individuals with daily step averages less than 7500 steps/day as either "sedentary" (fewer than 5000 steps/day) or "low active" (5000–7499 steps/day), while those with step averages above 7500 steps/day were stratified as either "somewhat active" (7500–9999 steps/day) or "active" (greater than 10,000 steps/day). A second measure of PA behavior was determined by calculating the difference in pedometer-measured PA between postintervention and baseline values. Participants that positively increased their PA (steps/day) were termed "responders" and those that either decreased or did not change were termed "nonresponders."

Statistical Analyses

The primary outcome measure was PA (steps per day); secondary measures included anthropometric/descriptive characteristics, cardiometabolic disease risk factors, and compliance measures. Outcome measures were evaluated at baseline immediately following the ALED-I intervention and 8 months after completion of the intervention by one-way repeated measures analysis of variance. When indicated by a significant *F* value, post hoc procedures were performed (Tukey). Hedges *g* effect size was computed to assess the magnitude of change for selected primary and secondary outcome measures.¹⁶ Linear regression analysis was performed with the observed change in steps (Δ = 8 months—baseline; Δ = 8 months—postintervention) as the response variables, and, as potential predictors, all baseline descriptive variables, measured change in selected secondary outcome measures and intervention compliance. Statistical significance was set a priori at $P < 0.05$. All data are presented as mean $\pm$ S.E.M.

Results

The 10 intent-to-treat control crossover participants who completed the ALED-I intervention after their four-month control group responsibilities significantly increased PA (+1337 steps/

day; $P = .04$; E.S. = 0.56) and reduced waist circumference ($\Delta = -4.0$ cm; $P = .04$; E.S. = 0.42). CRR decreased slightly ($\Delta = -0.3$) but was not statistically significant. No other changes in physical descriptors or cardiometabolic disease risk factors were observed in the 10 delayed intent-to-treat participants. In addition, these 10 participants did not differ from participants who were originally randomized to the ALED-I intervention for baseline descriptive and physical characteristics likely due to identical inclusion criteria.

At the 8-month follow-up time point, the 19 participants were 46.9 ± 2.4 years of age and normotensive (Table 1). For these participants, PA increased as a result of the ALED-I intervention but relapsed (-1340 steps/day; $P = .01$) at 8 months (Figure 2). At 8 months, 42% of the participants maintained PA levels above their baseline level with an effect size of 1.19. From the end of the intervention to 8 months, HDL levels decreased (Table 1), which resulted in a loss of the previously reported improvement in CRR. Total cholesterol and triglyceride levels were lower at 8 months compared with both baseline and postintervention. While the postintervention reduction in waist circumference was not statistically significant ($\Delta = -2.1$ cm; $P = .38$; E.S. = -0.24) in the 19 participants, this reduction was maintained at 8 months (Table 1). There were no other observed changes for cardiometabolic disease risk factors or physical descriptors at 8 months.

Figure 3a shows that the PA level achieved at the end of the ALED-I intervention predicts the PA level at the 8-month follow-up. This is supported by the magnitude of increase in PA during the intervention that is directly related to the magnitude of change in PA from baseline to 8 months (Figure 3b), where change in PA during the intervention explained 41% of the change from baseline to follow-up. Figure 3c shows that the least active participants at baseline were most likely to have the greatest change in PA levels from baseline to 8 months. Further investigation of the influence of baseline PA behavior utilizing pedometer-measured PA indices proposed by Tudor-Locke et al²⁸ revealed a significant increase in PA from baseline to postintervention ($P < .01$) in those participants achieving less than 7500 steps/day at baseline ($N = 12$), whereas participants achieving at least 7500 steps/day at baseline ($N = 7$) did not change their daily PA ($P = .15$; Figure 4, Panel A). Comparing ALED-I intervention responders ($N = 14$) and nonresponders ($N = 5$) revealed significant group differences in PA (steps/day) at both the postintervention ($P = .01$) and 8-month follow-up ($P = .04$) time points (Figure 4, Panel B). The responders significantly increased PA from baseline to postintervention ($P < .01$) but decreased PA significantly from postintervention to the 8 month follow-up ($P = .02$). Nonresponders did not increase PA as a result of the ALED-I intervention per our applied definition ($P = .13$) and experienced further reductions in PA at 8 months compared with baseline ($P = .02$; Figure 4, Panel B).

Number of journal activities completed and number of log-ins correlated positively ($r = .86$), but neither were associated with PA levels at 8 months, $P = .06$ and $P = .13$, respectively. Accessing the Web site at least once during the postintervention follow-up period was significantly related to PA levels at 8 months ($P = .02$) and change in PA from baseline to 8 months ($P = .04$).

Discussion

We previously demonstrated the short-term efficacy of the ALED-I intervention for increasing PA, when objectively measured in middle-aged, sedentary, and overweight adults.¹⁶ Evidence from this 8-month follow-up study confirms the short-term increase in PA (~16%) in 10 additional intent-to-treat control participants. However, contrary to our hypothesis, the 16-week ALED-I behavior modification program did not promote or facilitate longer-term adherence to the improved levels of PA achieved in this middle-aged, sedentary, and overweight adult population. Specifically, PA levels relapsed to levels nearly identical to those

before enrollment into the ALED-I intervention. At 8 months, approximately 25% of the sample maintained PA levels above their postintervention levels and 42% maintained PA levels above their baseline levels with a large effect size; these subgroup improvements, however, were insufficient to support significant longer-term efficacy of ALED-I intervention. These findings differ from Dunn et al who used a small group, classroom-delivery of the ALED program, and self-report PA.²¹ They reported sustained levels of PA above baseline at 18 months. To our knowledge, the current study is the first to test the longer-term efficacy of the internet-delivery medium.

The lack of PA adherence following the intervention, although discouraging, is not surprising. It has been previously reported that less than half of those who initiate any type of PA regimen will not continue the behavior thereafter.³ The participants enrolled in this study received no follow-up contact or intervention-delivery from the investigative team during the 8-month postintervention period. This was the intent of the study design and allowed us to assess permanency of the theory-based behavior change intervention devoid of external cues and/or support. Participants were, however, advised of their continued access to the ALED-I Web site for the upcoming year. Previous PA behavior change studies have traditionally followed up with participants less than one year following baseline and most after some form of a less intense/tapered version of the intervention.^{3,21,29} The use of a tapered form of the intervention during the maintenance/adherence period is meant to promote habituation of lifestyle PA,³⁰ but comparison studies utilizing a weaning period versus those that do not are largely unreported and necessary to rigorously assess the best practice for instilling long-term PA adherence. Evaluating and identifying best practice for long-term PA adherence is critical in light of the recent and escalating attention being given to the internet-delivery medium.^{10,31}

Explanations for the observed relapse in PA are numerous and largely beyond the design and purpose of the current study, but we provide some speculation. Theory-based PA interventions, a highlighted recommendation from the Surgeon General's report on PA, are known to be more efficacious than atheoretical interventions. Because small-group classroom delivery and internet delivery of the ALED program have repeatedly demonstrated efficacy and are theory-based (TTM and SCT), assessing their longer-term PA efficacy and influence on cardiometabolic disease risk factors is important to program modification and future use or promotion. Our findings suggest that the improvement in PA is transient, which may be partly explained by suggestions that most web-based programs are not interactive enough to fully engage participants³² resulting in irregular use of the Web site during the follow-up period. Introspection of the compliance data showed that participants completed only 24% of the possible journal activities and logged in every 8th day over the 16-week intervention. As the measures of intervention compliance were not significantly related to PA levels at 8 months but trended toward significance, it appears that the degree of compliance and engagement with the ALED-I program makes only minor contributions to long-term maintenance of PA. It is also possible that participants did not receive enough of the intervention to facilitate permanency of behavior change.³² Moreover, the lack of contact with participants during the follow-up period may have played a direct role in the PA relapse¹³ and may support the use of a weaning component during the maintenance period.³³ During the 8-month postintervention period, 47% of participants logged in to the Web site at least once and significant relations existed between this postintervention use of the Web site and PA levels at 8 months and change in PA from baseline to 8 months. This also provides support for weaning or some form of interaction postintervention when using internet-delivered programs. The large proportion of females (~74%) may have also played a role in the lack of PA adherence as previous studies have shown that women are often less physically active than men and are less likely to maintain improvements in PA.¹³ Environmental and cultural barriers such as lack of access to exercise facilities, fewer places to exercise, and lack of or fewer destinations within walking distance

have all been previously correlated with decreased PA in rural populations^{34,35} and may have influenced the longer-term PA adherence in these rural participants.

Three relations exist between absolute PA levels at baseline, postintervention, and 8 months along with change in PA levels between these time points. As previously reported, the degree of physical inactivity at baseline predicts the magnitude of improvement in PA during the intervention.¹⁶ The current study extends this finding, such that the degree of physical activity at baseline also predicts the overall change in PA from baseline to the 8-month follow-up. Further, comparisons between participants achieving less than versus more than 7500 steps/day suggest that significant short term and modest long-term improvements in PA are most likely to occur in a “sedentary” or “low active” (fewer than 7500 steps/day) population. In addition, 79% of the participants who increased their PA as a result of the ALED-I intervention, ie, responders, were also achieving less than 7500 steps/day at baseline enrollment. To summarize, the ALED-I program is most efficacious in the short term and long term in the least active (fewer than 7500 steps/day) overweight adults. These findings are similar to those from a previous study¹¹ in which participants who achieved recommended levels of PA²² by the end of either a print-based or individually tailored intervention were most likely to be physically active 6 months later as compared with those that did not achieve such PA levels. Our findings are also consistent with others^{33,36} in which prior PA behavior (sedentary) was the largest predictor of PA adherence to home-based PA during a maintenance phase. It appears that the intervention was most effective in both the short term and in the long term for those who had the most to gain from being physically active and less effective for those who were more active (≥ 7500 steps/day).

With respect to cardiometabolic disease risk factors, central adiposity was reduced in the intent-to-treat crossover participants, consistent with our previous findings.¹⁶ This reduction may be clinically significant because it was maintained 8 months later. The maintenance of reduced central adiposity likely contributed to the longer-term improvements in total cholesterol and triglyceride levels.³⁷ High-density lipoprotein levels relapsed significantly at 8 months, a finding that is consistent with the return of a sedentary lifestyle.^{38,39}

Limitations and Strengths

This study is limited by an attrition rate of 40% during the 8-month follow-up that is consistent with other internet-delivered interventions (7% to 69%)¹⁰ and our original study (51%).¹⁶ These findings are also limited by a relatively small sample ($N = 19$) of likely motivated volunteers that may not be representative outside of a predominantly Caucasian, rural population. However, the participants who completed the 8-month follow-up session were statistically similar in descriptive/physical characteristics compared with participants in the original study and those who did not complete the 8-month follow-up, so we believe that this small sample is representative of the rural resident pool who participated in the past. Seasonality is a possible confounder to our findings in that the delayed intent-to-treat participants completed the ALED-I intervention and 8-month follow-up phase 4 months later than participants initially randomized to the ALED-I intervention group. Lastly, all available participants with complete data were included in this follow-up study resulting in an estimated power 0.62, which was below desirable and prevented some statistical comparisons, such as seasonality comparisons. The current study would have been strengthened by 1) incorporating more sensitive and specific measures of intervention compliance and not solely relying on available measures provided by the commercial program’s backend database, 2) developing valid and reliable measures of participant’s assessment of how engaging and interactive the web-based system was,^{32,40,41} and 3) adhering to calls for measurement of and attention to mediating variables.^{42,43} This study employed an objective measure of PA and tracked participants long term without any postintervention contact or investigator-initiated weaning.

This allowed for a true illustration of postintervention PA behavior adoption following completion of the validated and theory-based ALED internet-delivered PA behavior change program.^{3,16,21}

Recommendations

It has been suggested that successful internet-delivered PA interventions encompass the following: 1) immediate and easy access to the intervention, 2) theory-based content, 3) encouragement of lifestyle PA behavior change, and 4) low-moderate intensity PA that is preferred by adult populations.⁴⁴ The ALED-I program conforms to all of these recommendations to at least a moderate degree, yet longer-term adherence of PA was only observed in the least active participants who realized short-term increases in PA and accessed the Web site during the postintervention follow-up period. Future efforts should focus on utilizing Web sites that incorporate interactive components and promote high engagement and longer adherence to Web site use.^{32,40,41} It is also important for researchers to identify those mediators that prepare participants for life after the intervention as these mediators may differ from those that facilitate initial adoption of the PA behavior.⁴⁵ Identifying a postintervention best-practice strategy for long-term PA adherence is critical.³ The internet-delivered ALED-I program may benefit from evidence-based modifications. However, in overweight adults, it appears to possess short-term efficacy for PA and cardiometabolic disease risk improvement¹⁶ and may theoretically have longer-term efficacy with the incorporation of some degree of postintervention best practice.

Conclusions

Our findings suggest that the 16-week ALED-I program, although efficacious in producing a short-term adoption of increased PA, did not instill long-term PA adherence in middle aged, sedentary, overweight/obese adults. Participants who were least active (fewer than 7500 steps/day) or near sedentary²⁸ benefited the most from the ALED-I program in the short and long term. These results warrant investigating approaches/interventions that may produce habituation of the observed short-term increase in PA. This should include direct attention to mildly active, overweight adults and postintervention Web-based weaning strategies.

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Figure 1.
Sequence of events and participant enrollment.

Figure 2.

Average steps per day for all 19 participants at baseline, postintervention and at 8-month follow-up. * $P < .05$ compared with *Baseline* time point. † $P < .05$ compared with *Post ALED-I* time point.

Figure 3.

Linear regression models. Study coordinated in Laramie, WY from January 2007 through November 2007. **Panel A.** Relation between postintervention step average and 8-month follow-up step average ($P = .01$; adjusted $R^2 = .28$). **Panel B.** Relation between change in steps from baseline to postintervention and the change in steps from baseline to the 8-month follow-up ($P = .003$; adjusted $R^2 = .41$). **Panel C.** Relation between baseline step average and change in steps from baseline to the 8-month follow-up ($P = .03$; adjusted $R^2 = .21$).

Figure 4.

Linear regression models. **Panel A.** Comparison of PA (steps/day) at baseline, postintervention, and 8-month follow-up by baseline PA behavior (< 7500 steps/day vs. ≥ 7500 steps/day). * $P < .05$ compared with baseline time point for participants achieving < 7500 steps/day at baseline. † $P < .05$ compared with participants achieving < 7500 steps/day at baseline within the baseline time point. **Panel B.** Comparison of PA (steps/day) between ALED-I intervention responders (positive changes in PA baseline to postintervention) and nonresponders (no change or reduction in PA baseline to postintervention) at baseline, postintervention and at 8-month follow-up. * $P < .05$ compared with baseline time point within groups (responder or nonresponder). † $P < .05$ compared with postintervention within groups (responder or nonresponder). ‡ $P < .05$ compared with nonresponder group within same time point.

Table 1

Descriptive and Physiological Characteristics at Baseline, Postintervention, and 8-Month Follow-up (N = 19)

	Baseline	Post ALED-I Intervention	Eight-month Follow-up	P Baseline vs. Post ALED-I	P Baseline vs. Follow-up	P Post ALED-I vs. Follow-up
Average Steps per Day	6755 ± 471	8190 ± 500*	6850 ± 544 [†]	0.02	0.89	0.01
Predicted VO ₂ peak (ml/kg/min)	35.4 ± 1.7	38.8 ± 2.9	36.0 ± 1.8	0.19	0.34	0.23
Systolic BP (mmHg)	121 ± 3	125 ± 3	123 ± 3	0.22	0.57	0.49
Diastolic BP (mmHg)	79 ± 2	80 ± 2	76 ± 1	0.26	0.15	0.03
Waist Circumference (cm)	99.2 ± 2.2	97.1 ± 2.2	97.2 ± 2.2	0.38	0.21	0.66
BMI (kg/m ²)	31.3 ± 1.0	31.5 ± 1.1	31.9 ± 1.1	0.46	0.69	0.07
Weight (kg)	90.2 ± 3.6	90.4 ± 3.8	91.6 ± 3.9	0.72	0.79	0.09
Body Fat (%)	41.7 ± 2.0	43.3 ± 2.2	43.7 ± 2.4	0.12	0.20	0.55
% Lean Mass	58.3 ± 2.0	56.7 ± 2.2	56.3 ± 2.4	0.12	0.20	0.55
Total cholesterol (mg/dL)	192 ± 11	186 ± 11	168 ± 10 ^{*†}	0.73	0.01	0.01
LDL (mg/dL)	115 ± 10	112 ± 8	107 ± 9	0.85	0.06	0.24
HDL (mg/dL)	44 ± 2	45 ± 2	38 ± 2 ^{*†}	0.27	0.01	0.01
Triglycerides (mg/dL)	143 ± 17	134 ± 16	105 ± 13 ^{*†}	0.37	0.01	0.03
Fasting glucose (mg/dL)	95 ± 3	97 ± 2	91 ± 2	0.88	0.17	0.08
Fasting insulin (μIU/mL)	8.1 ± 0.9	8.5 ± 1.0	8.2 ± 1.0	0.06	0.94	0.54
HOMA	2.2 ± 0.3	2.0 ± 0.3	1.8 ± 0.4	0.51	0.33	0.63
C-Reactive Protein (mg/L)	3.6 ± 0.9	3.1 ± 0.7	2.8 ± 0.7	0.45	0.31	0.44
Coronary Risk Ratio (CRR)	4.4 ± 0.3	4.2 ± 0.3	4.4 ± 0.3	0.12	0.98	0.12
Reynolds Risk Score ^a	1.5 ± 0.3	1.5 ± 0.3	1.5 ± 0.4	0.99	0.58	0.58

Mean ± S.E.M. Abbreviations: BMI = Body Mass Index; HOMA = Homeostatic Model Assessment—Insulin Resistance.

* $P < .05$ compared with baseline.[†] $P < .05$ compared with post ALED-I. Significance greater than $P < .01$ is denoted as $P < .01$.^aFemale participants only.