Evaluating a Nondirective Health Coaching Package and a Directive Coaching Package for Increasing Physical Activity

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EVALUATING A NONDIRECTIVE HEALTH COACHING PACKAGE AND A DIRECTIVE COACHING PACKAGE FOR INCREASING PHYSICAL ACTIVITY

By

Hailey E. Donohue

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EVALUATING A NONDIRECTIVE HEALTH COACHING PACKAGE AND A DIRECTIVE COACHING PACKAGE FOR INCREASING PHYSICAL ACTIVITY

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EVALUATING A NONDIRECTIVE HEALTH COACHING PACKAGE AND A DIRECTIVE COACHING PACKAGE FOR INCREASING PHYSICAL ACTIVITY

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By

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EVALUATING A NONDIRECTIVE HEALTH COACHING PACKAGE AND A DIRECTIVE COACHING PACKAGE FOR INCREASING PHYSICAL ACTIVITY

Abstract

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Physical inactivity is a worldwide public health problem. Applied behavior analysis has demonstrated success in this area; interventions such as goal setting, self-monitoring, and feedback have produced increases in physical activity of adults. Nevertheless, strategies with a more nondirective approach, such as health coaching, are gaining traction in practice independent of behavior analytic approaches. We do not know about the relative effects of nondirective approaches and the established, directive interventions in applied behavior analysis, or about client preference for nondirective and directive approaches. The present study employed a multiple baseline across participants design to evaluate a largely nondirective, client-centered health coaching approach for increasing physical activity of adults and the subsequent introduction of a directive coaching approach. Four adult females participated in the study remotely via telehealth. Active zone minutes were the primary dependent variable in the present study, and physical activity metrics were measured by the Fitbit Inspire 2. Meaningful increases in active zone minutes were observed for 1 of 4 participants, and preference for nondirective and directive coaching styles varied across participants.
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LIST OF ABBREVIATIONS

BMI  Body Mass Index
PAR-Q  Physical Activity Readiness Questionnaire
RCQ-TV  Readiness to Change Questionnaire (Treatment Version)
Min  Minutes
SMART  Specific, Measurable, Attainable, Relevant, Time-Based
CDC  Centers for Disease Control
WHO  World Health Organization
PND  Percent of Nonoverlapping Data
MET  Metabolic Equivalents
COVID-19  Coronavirus Disease 2019
CHAPTER 1: INTRODUCTION

Physical inactivity is a major public health problem worldwide. Insufficient physical activity is a leading risk factor for noncommunicable diseases such as heart disease, cancer, and diabetes, and it is now the fourth leading risk factor for mortality (World Health Organization, 2014; World Health Organization, 2018). Chronic health conditions associated with physical inactivity, such as obesity, place individuals at higher risk for further health-related problems including hypertension, high cholesterol, and stroke (Centers for Disease Control and Prevention, 2019a; Centers for Disease Control and Prevention, 2019b; Centers for Disease Control and Prevention, 2020; U.S. Department of Health and Human Services National Institutes of Health, 2013). On the other hand, engaging in sufficient physical activity provides many health benefits. Physical activity promotes healthy weight loss, helps to reduce blood pressure, and helps to reduce the risk of diabetes, heart attack, and stroke (Centers for Disease Control and Prevention, 2015).

To that end, specific guidelines for the recommended amounts of physical activity are made widely available. The World Health Organization recommends that adults between 18 and 64 engage in at least 150 min of moderate-intensity activity throughout the week (30 min of moderate-intensity activity per day), or 75 min of vigorous physical activity throughout the week, to stave off the negative effects of inactivity and reap the health benefits of an active lifestyle (World Health Organization, 2010; World Health Organization, 2018). Despite standard recommendations for healthy levels of physical activity, one in four adults worldwide does not meet these physical activity guidelines (World Health Organization, 2010; World Health Organization, 2018), which suggests that something needs to change.
Physical inactivity is a problem that requires changing behavior, and it has been of interest to behavior analysts since the 1970s (e.g., Wysocki et al., 1979). Recent measures of physical activity reported in the applied behavior analytic literature include direct observation of physical activity of children (Boga & Normand, 2017; Hustyi et al., 2011; Hustyi et al., 2012; Larson et al., 2011; Larson et al., 2013; Larson et al., 2014; McIver et al., 2009; Zerger et al., 2016), direct measures such as heart rate (e.g., Donaldson & Normand, 2009; Larson et al., 2011; McIver et al., 2009; McKenzie et al., 1991), and supplemental indirect measures such as weight loss (Donaldson & Normand, 2009; Normand, 2008; VanWormer, 2004). Furthermore, recent studies have targeted physical activity primarily in the form of step counts with children and adults (e.g., Andrade et al., 2014; Ek et al., 2016; Galbraith & Normand, 2017; Hayes & Van Camp, 2015; Hustyi et al., 2011; Kuhl et al., 2015; Kurti & Dallery, 2013; Li et al., 2018; Miller et al., 2018; Normand, 2008; Valbuena et al., 2015; Van Camp & Berth, 2018; VanWormer, 2004; Washington et al., 2014; Zerger et al., 2017). Recent and effective interventions for increasing physical activity in applied behavior analysis have included combinations of self-monitoring, goal setting, and feedback (Donaldson & Normand, 2009; Normand, 2008; VanWormer, 2004), as well as Contingency Management (Irons et al., 2013; Kurti & Dallery, 2013; Petry et al., 2011).

For example, VanWormer (2004), Normand (2008), Donaldson and Normand (2009), and Valbuena et al. (2015) reported increases in physical activity (measured via permanent product of steps, and calories expended and BMI, respectively) as a product of package interventions in the context of weekly repeated contacts with a coach, including combinations of self-monitoring activity by logging or sending metrics to the coach daily, coach-set goals, and vocal, written, or graphic feedback from the coach. This is to say that package interventions in applied behavior analysis, including coaching arrangements, have been successful across a
variety of measures of activity. However, what we’re seeing in research and practice in healthcare settings, is the adoption of a similar but independent approach to promoting health behaviors.

Health coaching has emerged as a nondirective, client-centered approach to health-related behavior-change. Health coaches do not diagnose conditions or prescribe treatment, rather, they are positioned as allied health professionals to help clients achieve health-related goals in an integrated healthcare system. There does not seem to be a widely accepted definition of health coaching; however, Wolever et al. (2013) reviewed the health and wellness coaching literature with the aim of producing one standard, consistent definition of the practice. Based upon their review, the authors identified that the majority of health coaches were medical or allied health professionals, and authors suggested that health coaching is:

A patient-centered approach wherein patients at least partially determine their goals, use self-discovery of active learning processes together with content education to work toward their goals, and self-monitor behaviors to increase accountability, all within the context of an interpersonal relationship with a coach. The coach is a healthcare professional trained in behavior change theory, motivational strategies, and communication techniques, which are used to assist patients to develop intrinsic motivation and obtain skills to create sustainable change for improved health and well-being. (Wolever et al., 2013)

The behavior of health coaches might be better understood through common features identified by Wolever et al. (2013), including repeated contacts with a coach, client-set goals, self-monitoring progress toward the goal, client-led discussion evoked through motivational interviewing techniques, and access to health-related information shared by the coach. Although
these are some common components identified across the majority of health coaching studies (Wolever et al., 2013), what health coaching looks like in each session varies, both across clients and across individual sessions. In this way, it is a somewhat loosely defined independent variable.

Nevertheless, the client-centered practice of health coaching is growing, as is the number of peer-reviewed articles in the field (Wolever et al., 2013). Reviews of the effectiveness of health coaching suggests it has some potential (Dejonghe et al., 2017; Kivela et al., 2014; Lindner et al., 2003; Olsen & Nesbitt, 2010), but the research methods used are limited in ways that make it difficult to draw conclusions about efficacy and effectiveness. Most studies which evaluated health coaching interventions used nonrandomized group designs, experienced substantial attrition, and did not directly measure the behavior(s) of interest (Kivela et al., 2014; Lindner et al., 2003; Olsen & Nesbitt, 2010; Simmons & Wolever, 2011; Wolever et al., 2013). The methods used in applied behavior analysis could be applied to the field of health coaching to address many of the limitations of the health coaching literature (Normand & Bober, 2020). Operationally defining one or more target behaviors, directly observing and measuring the behavior(s) of interest over time, and evaluating the effects of health coaching interventions using single-case research designs would address the previously-mentioned limitations of the existing health coaching research base.

In summary, physical inactivity is a worldwide concern which requires behavior change. Applied behavior analysts have demonstrated effective strategies for improving physical activity. We are now seeing a similar but independent approach, health coaching, emerge in research and practice. Health coaching has a promising place in the healthcare system for allied health professionals to deliver behavior-change strategies for improving health behavior, and it is
growing in research and practice; however, we do not know much about the effectiveness of health coaching interventions. We do know that health coaching shares common components with effective interventions for increasing physical activity in applied behavior analysis, but there are important differences that may influence effectiveness. The nondirective approach taken by health coaches, including, but not limited to, client-set goals evoked through motivational interview strategies, differs from the more directive approach taken by behavior analysts. Therefore, the purpose of the present study is to evaluate the effects of a largely nondirective, client-centered health coaching approach for increasing physical activity of adults, and the relative effects of a directive coaching approach.
CHAPTER 2: METHOD

Participants

Participants were four adult women (19-22 years of age) recruited via an electronic flyer posted to the University of the Pacific Student Health Services Instagram profile (see Appendix C). We invited interested individuals to attend an initial screening session via Zoom, a peer-to-peer cloud-based web conferencing application. During the screening session, participants first completed the informed consent process (see Appendix D), then completed the following surveys, distributed and returned by email: 1) the Physical Activity Readiness Questionnaire (PAR-Q; see Appendix E; American Council on Exercise, 2017, p.272), a screening tool to identify potential participants for whom moderate-to-vigorous intensity physical activity is not recommended, 2) an adapted version of the Readiness to Change Questionnaire (Treatment Version) (RCQ-TV; see Appendix F; Heather & Honekopp, 2008), a tool used to measure a potential participant’s stage of change, typically related to substance abuse but adapted for physical activity in this case, and 3) a questionnaire (see Appendix G) to collect participant demographics and information about prior experience with activity monitors.

Eligibility criteria were (a) being between 18 and 55 years of age, (b) having sufficient internet access to meet weekly via Zoom, and (c) possessing a personal device that could be used to access Zoom (e.g., smartphone, tablet, laptop). Exclusionary criteria were (a) having undergone major surgery within the last 6 weeks, (b) answering “Yes” to any question on the PAR-Q, or (c) indicating any other risk for serious injury as a product of involvement in the study. Four individuals indicated interest in the study; all four individuals met the inclusion criteria and subsequently participated in the study.
Setting and Materials

All research activities involving subjects occurred online via Zoom. Participants participated in coaching sessions alone, in a quiet location with minimal distractions present. We aimed for sessions to be approximately 30 min in length, consistent with the 35.8-min average health coaching session duration identified by Wolever et al. (2013). We measured session length from session videos following the conclusion of the study using a stopwatch from the start of the first word spoken by either the coach or the participant, to the end of the last word spoken by either the coach or the participant. We measured session length in this fashion for all coaching sessions, and we omitted the screening session and Fitbit setup session from session length data to limit the amount of non-coaching-related content included in session length measures. However, some coaching sessions (e.g., the first directive session and the final session) included time spent on social validity surveys. Average session length across participants and conditions was 30:06 min, ranging from to 21:01 min to 51:18 min.

To measure physical activity, we used the Fitbit Inspire 2, a wireless fitness tracker with a touchscreen display worn on a wristband. We delivered the Fitbits to participants without physical contact (i.e., by mail for two participants and by contactless drop-off for two participants). During the initial Zoom session following screening, we explained the purpose and uses of the Fitbit device, and participants kept the Fitbit Inspire 2 after completing the study. The devices synced to an online account via the Fitbit app installed on the participants’ mobile devices. We created unique online accounts for each Fitbit device, and each participant had access to the account paired with their device for the duration of the study.
Response Measurement and Reliability

The primary dependent variable was a permanent-product measurement of active zone minutes, as recorded by the Fitbit Inspire 2. Secondary dependent variables include other metrics recorded by the Fitbit device (i.e., calories burned, distance traveled in miles, and steps per day) apart from sleep-related metrics; therefore, participants were only instructed to wear the device during waking hours. Treatment adherence was measured as a tertiary dependent variable, as described below.

The experimenter recorded the number of days each participant wore their Fitbit device, beginning the day of the Zoom meeting to set up the Fitbit and continuing throughout the completion of the final experimental session. The Fitbit Inspire 2 automatically syncs with the Fitbit app throughout the day. If a participant’s Fitbit account did not indicate device use (i.e., the device had not yet synced to the account, or the device synced but no data were recorded) by approximately 12:00 p.m. on a given day, the experimenter sent a reminder text to the participant asking them to wear the device and to sync it to their account.\(^1\) Additionally, the experimenter recorded the number of days on which each participant submitted their account metrics (see below). If the experimenter did not receive a message containing the participant’s metrics by their selected time each day, the experimenter sent a reminder text to the participant asking them to send the message. Finally, the experimenter collected data on attendance during weekly meetings as a measure of treatment adherence specific to Zoom sessions.

\(^1\) The Fitbit Inspire 2 battery lasts up to 10 days before requiring a charge. The participant determined a day of the week during which they would charge the Fitbit device weekly. We programmed each device to send email notifications to the unique Fitbit account email whenever the device battery needed to be charged. When the experimenter received the low-battery email notification for a device, the experimenter contacted the participant via their preferred contact method (email or text) to prompt them to charge their device.
Procedure

Following the initial screening session, participants attended a baseline session to set up their Fitbit device, followed by 6 weekly 30-min coaching sessions (apart from Participant 1 who withdrew following her fifth session) and one optional, 30-min session as a measure of social validity. Weekly coaching sessions began with 3 weeks of nondirective health coaching sessions (see below), followed by 3 weeks of directive coaching sessions (apart from Participant 1, as previously mentioned; see below). Participants moved from nondirective coaching to directive coaching after a minimum of 2 weeks in the nondirective coaching phase so long as the active minutes recorded were stable (i.e., minimal variability and no trend in the desired direction of change) based on visual inspection of the Fitbit data, or after 3 weeks had passed, whichever occurred first. All participants in the present study moved into directive coaching after 3 nondirective coaching sessions (approximately 3 weeks). Table 1 summarizes the similarities and differences across the baseline, nondirective, and directive coaching sessions. We used a concurrent multiple-baseline across participants design to evaluate the effectiveness of the nondirective coaching and directive coaching interventions.

Baseline

During baseline, we told participants they were being placed on the waitlist for coaching sessions, but that they should still wear their Fitbit device every day during waking hours. Participants met with the coach who familiarized them with the features of the Fitbit Inspire 2 and described how the device can be used. We instructed participants to access their Fitbit account at the end of each day or beginning of the following day and to e-mail or text their physical activity metrics (i.e., total daily step count, calories burned, distance traveled in miles, and active zone minutes) to the experimenter. This was intended to control for any reactivity
that might occur as participants self-monitored their data across phases. If the experimenter did not receive a text or email of the participant’s daily metrics at the participant’s selected time, the experimenter sent a prompt via the participant’s preferred method of communication (e.g., text or email). Self-monitoring in this fashion continued through all phases of the study. Participants wore the Fitbit for a minimum of 1 week before the nondirective health coaching sessions began. Participants moved into nondirective health coaching in staggered succession, after at least one week had passed since previous participants had begun nondirective health coaching, and so long as there was stability in baseline responding based on visual inspection of the Fitbit data (i.e., minimal variability and no trend in the desired direction of change).

**Nondirective Health Coaching**

During the first nondirective health coaching session, the experimenter explained the role of a health coach. The experimenter then conducted a brief motivational interview with the participant to ascertain their physical activity goals and values. See Appendix H for example motivational interview questions. During the subsequent nondirective health coaching sessions, participants continued to receive nondirective health coaching, delivered once weekly in approximately 30-min sessions. During coaching sessions, the experimenter continued to use motivational interviewing techniques such as summary statements, reflection, and open-ended questions to discuss topics such as the participant’s goals, health-related values, and barriers to change.

**Self-monitoring.** Participants continued to self-monitor as instructed during baseline. Participants sent all physical activity metrics (i.e., total daily step count, calories burned, distance traveled in miles, and active zone minutes) to the experimenter via their preferred method of communication at their chosen time daily.
**Goal setting.** The experimenter prompted the participant to set goals that were specific, measurable, attainable, relevant, and time-based (i.e., S.M.A.R.T.); however, the experimenter did not set or suggest goals for the participant. The experimenter facilitated discussion about barriers and possible solutions to meeting their goals using open-ended questions. The experimenter was prepared to offer health information to the participant if the participant requested resources, or if the participant indicated other health-related goals that could not be measured by the Fitbit, or any non-health-related goals; however, this was never necessary.

**Feedback.** If a participant met their self-set goals from the previous session, the experimenter provided general praise. If not, the experimenter provided general statements of encouragement. See Appendices I and J for a session flowchart and example script, respectively.

**Directive Coaching**

At the start of directive coaching phase, the experimenter selected active zone minutes as the primary dependent variable if participants had not already self-selected them as their target behavior in the nondirective health coaching phase, and the experimenter calculated the specific goals using a percentile schedule of reinforcement (Galbicka, 1994), as described below. The experimenter provided qualitative and quantitative feedback in the form of visually inspecting graphed active minute data with the participant.

**Self-monitoring.** Participants continued to self-monitor as instructed during baseline, but now we also instructed them to send the experimenter an e-mail or text containing only their daily active zone minutes, as opposed to all physical activity metrics (i.e., total daily step count, calories burned, distance traveled in miles, and active zone minutes) at their chosen time daily.

**Goal setting.** The experimenter set weekly active zone minute goals for the participant based on their previous week’s data using a percentile schedule of reinforcement to specify the
response criterion. A percentile schedule is a mathematical way to set explicit and objective criteria for reinforcement based on an individual’s previous responses (Galbicka, 1994). We used the following equation to set goals: \( k = (m+1)(1-w) \), where \( k \) = the rank of the previous week’s daily active zone minute values which the next week’s daily values must meet or surpass to receive praise and for the goal to be considered met, \( m \) = the number of previous days which were taken into consideration, and \( w \) = the probability of achieving a response which meets criterion. In the present study, \( m \) was set to 7 to include the full prior week of data to establish the next week’s goal, and \( w \) was set to 0.4 so that praise would follow 40% of responses. Therefore, the equation used in the present study was \( k = (7+1)(1-0.4) \), or \( k = 5 \), meaning that once directive coaching began, 5 of the 7 data points from a given week must have surpassed the fifth highest active minute value from the previous 7 days to receive praise and qualify as having met that week’s goal. Subsequently, a new goal would be set. If a participant did not meet their goal, the goal remained the same the following week. In the present study, goals were not to be set lower than a previously set goal. If the percentile schedule equation were to have indicated a lower goal than that of the previous week, the previous week’s goal would be used, instead; however, this was never necessary. See Appendix K for an example application of the percentile schedule to daily active zone minute data.

**Feedback.** We provided participants feedback on their performance relative to their goals by visually analyzing the graphed data with them during weekly 30-min coaching sessions. The coach highlighted and described active zone minute data relative to the assigned goal each week and compared and contrasted performance in the most recent week to earlier weeks. Additionally, the coach would display and discuss patterns in the active zone minute data. For example, the coach might draw attention to an increasing or decreasing trend, a pattern of higher
active zone minutes on weekends compared to weekdays, or a change across weeks from high variability around the goal line to low variability around the goal line, or vice versa. Participants 1 and 2 chose to target a metric other than active zone minutes in nondirective coaching, so the coach compared those data to active zone minute data. For example, the coach would display step count and active zone minutes together and highlight days on which step count was high but active zone minutes remained low, segueing into discussion about the importance of the intensity of physical activity as recommended by the CDC and WHO. We continued to provide participants with praise when they met their goals and statements of encouragement when they did not meet their goals. The experimenter also provided relevant health info to the participant, stressing its importance as rationale for increasing their level of physical activity (see Table 2 for sources of health-related information). See Appendices L and M for a flowchart of a directive sessions and an example script, respectively.

**Social Validity**

At the conclusion of the last regularly scheduled coaching session of each phase, we asked each participant to complete an anonymous social validity questionnaire (see Appendix N). Furthermore, we offered participants the opportunity to participate in an additional health coaching session the following week. If the participant chose to attend an additional session, we gave them the option to choose between a nondirective coaching session or a directive coaching session. We assessed this aspect of social validity in three ways: (a) whether the participant opted into the additional session, (b) which session type they chose, and (c) whether they attended the additional optional session.
Independent Variable Check

Prior to the start of the study, we recorded a mock nondirective coaching session, and a certified health and wellness coach employed by the University of the Pacific Student Health Services viewed the video. The health and wellness coach rated the mock session in terms of its resemblance to a typical health coaching session (see Appendix O for the health coaching rating form). The health coaching rating form was designed by the experimenter, and it has not been evaluated with respect to validity or reliability. In total, the rating form included 12 items to be rated by the certified health and wellness coach.

The first nine items on the form were presented as statements, and the health coach endorsed the items on a scale of 1 to 7. All nine items were positive statements about the procedures used (e.g., “I found the health coaching session to be nondirective,” and, “I believe the health coach appropriately supported participant goal-setting.”) Therefore, strong agreement was desired. A score of 1 represented Strongly Disagree, a score of 4 was considered Neutral, and 7 represented Strongly Agree. Therefore, in this section, possible scores ranged from 9-69, in which a total score of 9 would represent strong disagreement with all statements and a total score of 69 would represent strong agreement with all statements. The health coach responded to all nine statements with scores ranging from 5-7, indicating agreement to strong agreement with all statements.

The final three items on the form were represented as components of the coaching (i.e., the style and format of discussion, goal setting, and feedback statements used), and the health coach endorsed the items on a scale of 1 to 7. On these items, a score of 1 represented Strongly Dislike, a score of 4 was considered Neutral, and a score of 7 represented Strongly Like. Therefore, in this section, possible scores ranged from 3-21, in which a total score of 3 would
represent strong dislike of all three components, and a total score of 21 would represent strong like of all three components. The health coach responded to these three statements with scores ranging from 5-6, indicating they liked the three components of the coaching.

We also recorded all study sessions. Two researchers independently scored a minimum of 30% of study sessions in terms of the duration of time the participant was speaking and the duration of time the experimenter was speaking. Additionally, the same researchers independently scored the frequency of open-ended questions posed by the experimenter and discussed disagreements until a consensus was reached. Finally, researchers scored whether session data were reviewed graphically with the participant, whether health info was given and stressed as rationale for the participants’ goal, and whether a goal was assigned to the participant by the experimenter or selected by the participant themselves. These data were collected to quantitatively describe components of coaching sessions which were manipulated across nondirective and directive coaching styles.

Data Analysis

We analyzed the primary dependent variable, daily active zone minutes, using visual analysis of the graphed daily totals for each participant. Additionally, as a quantitative measure of effect size, we calculated the percent of nonoverlapping data (PND) of active zone minutes between phases for all participants (Table 3). PND, first suggested by Scruggs et al. (1987), is calculated by dividing the number of data points that fall above the highest value in the comparison phase by the total number of data points in the comparison phase and multiplying by 100.

Finally, we analyzed active zone minutes using visual analysis of the 7-day moving average of daily values. Each data point in those data paths depict the average of that data point
and the data points from the six preceding days. Therefore, the first data point graphed in the 7-day moving average data stream for each participant is plotted seven days following their first day in the baseline phase. We chose to plot data in terms of the 7-day moving average, as opposed to the average of consecutive 7-day periods, to allow for visual analysis of trends within weeks, which may be obscured by plotting weekly averages. The high degree of variability in daily active zone minute data within participants can make visual inspection of changes in level, trend, and variability difficult. This challenge has been identified in terms of other measures of activity (e.g., steps), as well (Valbuena et al., 2017). This approach to graphing the data reduces the appearance of variability, which can aid in visual inspection of trends (Valbuena et al., 2017). However, it should be highlighted that ongoing data evaluation and decision-making in the present study were done with respect to daily active zone minute totals. The nature of physical activity as a dependent variable makes averages appropriate because performance across multiple days or weeks represents a clinically relevant unit. Increases in activity, on average, across the week can be clinically relevant, even if some variability in daily values is evident (Valbuena et al., 2017). Additionally, global recommendations for sufficient physical activity are offered in terms of weekly ranges (World Health Organization, 2010; World Health Organization, 2018).
CHAPTER 3: RESULTS

Demographics

Demographic characteristics of the four participants are shown in Figure 1. Participants ranged between 19-22 years of age. When asked in a multiple-choice format to select their sex, all four participants reported female biological sex. When asked in a free response format to describe their current gender identity, all four participants self-identified as female. When asked in a multiple-choice format to select all categories that describe them with respect to race, one participant selected “White,” one selected “Vietnamese,” one selected “Black or African American,” and one selected “Chinese.” When asked in a multiple-choice format to indicate whether they are of Hispanic, Latino, or Spanish origin, all participants indicated they were not. Two of four participants reported their highest level of education completed was a high school diploma, and the remaining two participants reported their highest level of education completed was a bachelor’s degree. Three of four participants reported that they were never married, and one participant reported they were separated. One participant indicated they were currently employed part-time (i.e., 21-34 hours/week), one participant indicated they were currently employed full-time (i.e., 35-49 hours/week), and two participants indicated they were currently students.

Readiness to Change

Participants completed an adapted version of the Readiness to Change Questionnaire during the screening meeting via Zoom (Treatment Version) (RCQ-TV; see Appendix F; Heather & Honekopp, 2008), sent to them as a PDF. Participants endorsed 12 items related to their level of physical activity at the time of enrollment in the study (e.g., “There is nothing seriously wrong
with my current levels of physical activity,” and, “My level of physical activity is a problem sometimes”) with a response of “Strongly Disagree,” “Disagree,” “Unsure,” “Agree,” or “Strongly Agree.” All items were scored on a 5-point scale ranging from -2 to 2, respectively. Scores were then added across items that corresponded to the same scale. A negative scale score reflected an overall disagreement with items measuring the stage of change, whereas a positive score represented overall agreement. Therefore, the highest scale score represented the given participant’s Stage of Change designation. Scores for Participants 1 and 3 suggested a Contemplation designation, whereas scores for Participants 2 and 4 suggested an Action designation.

**Treatment Integrity Analysis**

Table 4 displays the results of the treatment integrity analysis. Researchers scored four total nondirective coaching sessions (i.e., one session from each participant) and five total directive coaching sessions (i.e., one session from Participants 1, 3, and 4, and two sessions from Participant 2 who opted into an additional directive session). The mean percent of total speaking time during which the participant was speaking was 50% during nondirective coaching sessions (range 43-56%) and 9% during directive coaching sessions (range: 1-14%). Percent of speaking time data recorded by the secondary coder were within 2% of those recorded by the primary coder for both participant and coach samples across all sampled sessions. Therefore, only the primary coder’s data are reported with respect to the percent of speaking time during which the participant and coach were speaking. See Figure 2 for the percent of total speaking time during which the participant was speaking and the coach was speaking in each video sampled. The mean percent of total speaking time during which the coach was speaking was 50% during nondirective coaching sessions (range: 44-57%) and 91% during directive coaching sessions.
The mean number of open-ended questions asked by the coach was 13.5 during non directive coaching sessions (range: 11-15) and 2.8 during directive coaching sessions (range: 1-4). The coach reviewed a graph of the participant’s data with them during 0% of non directive coaching sessions and 100% of directive coaching sessions. Similarly, the coach shared health resources with the participant during 0% of non directive coaching sessions and 100% of directive coaching sessions. Finally, the participant set their own goal during 100% of non directive coaching sessions, whereas the coach assigned the participant a goal in 100% of directive coaching sessions.

**Active Zone Minutes**

Table 5 displays the specific goals set by participants in each week of the non directive coaching phase and assigned to them in each week of the directive coaching phase. Self-selected goals varied within and across participants during non directive coaching. Daily active zone minute totals for each participant are shown in Figure 3. Horizontal dashed lines in non directive and directive coaching phases in Figure 3 indicate the value of the active zone minute goal in place (there are no goal lines in non directive coaching for P2 or the third week of non directive coaching for P3, because these participants chose to set goals steps in those weeks). Closed and open squares below each participant’s active zone minutes panel in Figure 3 depict whether the participant met or failed to meet the active zone minute goal in place on that day, respectively.

We observed an increase in level of daily active zone minutes for Participant 1 at the points at which non directive coaching and directive coaching were introduced, and we did not see changes in the level or trend of daily active zone minutes at those same times across other participants for whom a phase change did not take place. Therefore, Participants 2-4 served as controls for the introduction of each coaching approach for Participant 1, to whom Participant
1’s active zone minute data can be compared. However, we did not see any replications of the increase in daily active zone minutes observed for Participant 1 when nondirective or directive coaching were introduced across other participants. Therefore, experimental control was not demonstrated and conclusions cannot be drawn about the effects of either coaching approach.

Systematic increases in secondary measures of physical activity (i.e., steps, distance traveled, and calories expended) were not observed for any participants. Analysis of the 7-day moving average of daily active zone minutes, shown in Figure 4, did not reveal any additional information; in other words, an overall increase in active zone minutes across phases was observed only for Participant 1 and not replicated across other participants. Individual goals and active zone minute data are described in greater detail for each participant below.

**Participant 1.** Participant 1 chose to target active zone minutes during all three weeks of the nondirective coaching phase, and the coach assigned active zone minute goals during the directive coaching phase. See Table 5 for a description of each weekly goal in place for Participant 1. It should be noted that the active zone minutes goal that was set for Participant 1 using the percentile schedule at the start of the directive coaching phase was set too high based on a measurement error. The goal was set based on the active minute data for the previous 7 days obtained from the participant’s Fitbit account accessed via a web browser, as opposed to the active zone minute data available from the same account via the Fitbit app. These measures differ in the following ways. Active minutes capture duration of activity through metabolic equivalents (METs) using the participant’s body mass to estimate activity intensity and heart rate, and the Fitbit device begins tracking active minutes once an individual has spent 10 min in moderate-to-vigorous activity. On the other hand, active zone minutes capture duration of activity through heart rate, and the Fitbit device tracks one zone minute for every minute spent in
the fat burn zone and two zone minutes for every minute spent in the cardio or peak heart rate zones (Fitbit, 2021). Setting Participant 1’s weekly active zone minute goal using active minute data resulted in a higher goal (i.e., 58 active zone minutes per day on at least five of seven days) than would have resulted from their active zone minute data (i.e., 44 active zone minutes per day on at least 5 of 7 days).

Nevertheless, Participant 1 was the only participant to meet any of their weekly goals. Participant 1 met their self-set active zone minute goal in their final (i.e., third) week of the nondirective coaching phase, and the active zone minute goal assigned in their final (i.e., second) week of the directive coaching phase. As previously mentioned, Participant 1 requested to conclude the study during the coaching session at the culmination of their second week in the directive coaching phase due to an upcoming vacation; therefore, they are the only participant to have only 2 weeks in the directive coaching phase.

The data shown in Figure 3 suggest that active zone minutes increased for Participant 1 from baseline to nondirective coaching and increased again from nondirective to directive coaching. The level of active zone minute data increased from baseline to nondirective coaching and again from nondirective coaching to directive coaching, and variability increased from nondirective coaching to directive coaching. Although goals were in place with respect to an entire week at a time, we also analyzed daily data in terms of having met or not met the goal in place on that day for purposes of comparing performance between phases. Participant 1 met their self-selected active zone minute goal on 71% of days in the nondirective coaching phase and met their assigned active zone minute goal on 60% of days in the directive coaching phase. Participant 1 achieved 35% PND between the nondirective coaching and baseline phase, 7.14% PND between the directive and nondirective coaching phases, and 64.29% PND between the
directive coaching phase and baseline. See Figure 5 for a display of Participant 1’s performance across all physical activity metrics recorded by the Fitbit.

**Participant 2.** Participant 2 chose to target steps during all three weeks of the nondirective coaching phase, and the coach assigned active zone minute goals during the directive coaching phase. See Table 5 for a description of each weekly goal in place for Participant 2. Participant 2 did not meet any of their weekly goals across the nondirective or directive coaching phases. The data shown in Figure 3 suggest that active zone minutes did not increase across phases for Participant 2. Variability in active zone minutes decreased in the final (i.e., third) week of directive coaching and remained low in the additional optional social validity week; however, it should be noted that Participant 2 reported having more free time beginning on June 28, 2021 due to the conclusion of their summer course. Participant 2 met their self-set step goal on 77.27% of days in the nondirective coaching phase. Additionally, they met their assigned active zone minute goal on 19% of days in the directive coaching phase and 57% of days in the additional, optional social validity week in the directive coaching style. Participant 2 achieved 0% PND between nondirective coaching and baseline, 10% PND between directive and nondirective coaching phases, 0% PND between directive coaching and baseline, and 0% PND between the additional optional week in directive coaching and the directive, nondirective, and baseline phases. See Figure 6 for a display of Participant 2’s performance across all physical activity metrics recorded by the Fitbit.

**Participant 3.** Participant 3 chose to target a combination of multiple measures during all three weeks of the nondirective coaching phase, and the coach assigned active zone minute goals during the directive coaching phase. See Table 5 for a description of each weekly goal in place for Participant 3. Participant 3 did not meet any of their weekly goals across the
nondirective or directive coaching phases. The data shown in Figure 3 suggest that active zone minutes were on a decreasing trend across the first week of nondirective coaching, then remained low. It should be noted that Participant 3 began a full-time internship on 6/7/21. Participant 3 met their self-set goals in the nondirective phase on 22.73% of days. Participant 3 targeted active zone minutes as one component of their self-set goals for the first two of three weeks in the nondirective coaching phase and met that component of their goal on 54% of days in the nondirective coaching phase. They met their assigned active zone minute goal on 58% of days in the directive coaching phase. Participant 3 achieved 0% PND between the nondirective coaching and baseline phase, 8.70% PND between the directive and nondirective coaching phases, and 4.35% PND between the directive coaching and baseline phase. See Figure 7 for a display of Participant 3’s performance across all physical activity metrics recorded by the Fitbit.

**Participant 4.** Participant 4 chose to target active zone minutes during all three weeks of the nondirective coaching phase, and the coach assigned active zone minute goals during the directive coaching phase. See Table 5 for a description of each weekly goal in place for Participant 4. Participant 4 did not meet any of their weekly goals across the nondirective or directive coaching phases. The data shown in Figure 3 suggest that variability in active zone minutes decreased at the introduction of the directive coaching phase, and the first three data points in the phase adhered closely to the experimenter-set goal. However, active zone minutes were variable again in the second and third weeks of the directive coaching phase. Participant 4 met their self-selected active zone minute goal on 52% of days in the nondirective coaching phase and met their assigned active zone minute goal on 43% of days in the directive coaching phase. Participant 4 achieved 0% PND between the nondirective coaching and baseline phase, 10.00% PND between the directive and nondirective coaching phases, and 0.00% PND between
the directive coaching and baseline phase. See Figure 8 for a display of Participant 4’s performance across all physical activity metrics recorded by the Fitbit.

**Adherence**

Adherence with respect to wearing the Fitbit device daily was high across all participants. Participants 1, 2, and 4 wore their Fitbit device on 100% of days across all phases of the study, and Participant 3 wore their Fitbit device on 97% of days (i.e., 84 of 87 days) across all phases of the study. Participant 3 failed to wear the device on 1 day during baseline and 2 days during the directive coaching phase.

With prompts, adherence with respect to sending physical activity metrics to the experimenter each day was high across all participants. Participant 1 required prompts on 50% of days (i.e., 29 of 58 days), and metrics were received by the experimenter on the same day or one day later on all days. Participant 2 required prompts on 30% of days (i.e., 25 of 83 days), and metrics were received by the experimenter on the same day or one day later on all days. Participant 3 required prompts on 78% of days (i.e., 68 of 87 days), and metrics were received by the experimenter on the same day or one day later on all but 4 days, for which no metrics were received despite reminders. Participant 4 required prompts on 23% of days (i.e., 23 of 100 days), and metrics were received by the experimenter on the same day on all days.

Participant 1 requested to conclude the study during the coaching session at the culmination of their second week in the directive coaching phase due to an upcoming vacation; therefore, Participant 1 attended 3 of 3 scheduled nondirective coaching sessions and 2 of 3 scheduled directive coaching sessions. Participants 2 and 4 attended all six coaching sessions, with occasional postponement prior to the scheduled meeting time due to scheduling conflicts. Participant 3 was absent from one scheduled meeting during the directive coaching phase which
they later reported was due to a job conflict; the meeting was successfully rescheduled afterwards.

**Social Validity**

We offered all participants one additional week in the study at the conclusion of their final week in the directive coaching phase. We offered participants the chance to participate in the additional week via an electronic social validity questionnaire administered via email during the final nondirective coaching session, with the exception of Participant 1, for whom we offered an additional week directly via email following their vacation as a result of their early withdrawal from the study. Participant 2 was the only participant to opt into an additional week beyond the conclusion of the final week in the directive coaching phase. Participant 2 selected the directive coaching style for their additional week and attended their additional meeting. The active zone minute goal from the final week of the directive coaching phase was carried over into the additional week; however, Participant 2 did not meet their goal in the additional week.

Figure 9 displays participants’ degree of endorsement of the statements provided on the social validity questionnaire at the conclusion of the nondirective coaching phase. Three of four participants endorsed positive statements (e.g., “I enjoyed talking to the coach”) between “Neutral” and “Strongly Agree.” Participant 3 selected “Disagree” in response to the statement, “submitting my active minutes to the coach was helpful in increasing my physical activity.” Participant 3 chose to target multiple metrics during nondirective coaching, including, but not limited to, active zone minutes. All participants endorsed negative statements (e.g., “It was difficult to participate in this study”) between “Neutral” and “Strongly Disagree.” Figure 10 displays the participants’ degree of endorsement of the same statements given to them at the conclusion of the directive coaching phase. Three participants endorsed positive statements
between “Neutral” and “Strongly Agree,” and Participant 3 again selected “Disagree” in response to the statement, “submitting my active minutes to the coach was helpful in increasing my physical activity.” Participants 1, 2, and 3 endorsed negative statements between “Neutral” and “Strongly Disagree.” Participant 4 selected “Agree” in response to the statement, “I disliked the level of involvement I had during coaching sessions.”

Figures 11-14 display endorsement of the social validity statements with respect to the nondirective coaching phase and directive coaching phase for participants 1-4, respectively, to allow for comparison of social validity between phases. Participants 1 and 3 rated all statements equally or within one level of difference in endorsement between the nondirective and directive coaching phases, suggesting no meaningful difference in response to these statements between coaching types. Participants 2 and 4 differed in that they endorsed one and two statements, respectively, with a difference greater than one level between the nondirective and directive coaching phases. Namely, in response to the statement, “submitting my active minutes to the coach was helpful in increasing my physical activity,” Participant 2 selected “Neutral” with respect to nondirective coaching, and “Strongly Agree” with respect to directive coaching. It should be noted that Participant 2 self-selected steps as a target during nondirective coaching, and the coach assigned active zone minutes as a target during directive coaching; however, this social validity statement still applied to both nondirective and directive coaching phases, because participants submitted daily totals of all physical activity metrics (including active zone minutes) to the experimenter during nondirective coaching and solely submitted active zone minute totals during directive coaching. Additionally, In response to the statement, “I would recommend this type of coaching to a friend,” Participant 4 selected “Strongly Agree” with respect to nondirective coaching, and “Neutral” in response to directive coaching. Finally,
In response to the statement, “I disliked the level of involvement I had during coaching sessions,” Participant 4 selected “Disagree” with respect to nondirective coaching, and “Agree” with respect to directive coaching.

Table 6 displays participants’ reported preference when asked to select whether they preferred when the coach took the lead during sessions (i.e., directive coaching), when they took the lead during sessions (i.e., nondirective coaching), or if they liked both styles equally. Participants 2 and 3 reported having preferred the directive coaching phase. When given space to provide comments as to why they selected their response, Participant 1 reported liking both styles equally and stated, “I think the coach should set the goal, but there should be more discussion about how the participant can improve their levels and reach the goals. Both parts were equally as necessary.” Participant 2 stated, “Initially, my goal was focused on increasing steps. When I was educated about active zone minutes per day/per week from the coach, I understood that reaching this particular goal provides a lot more health benefits.” Participant 3 stated, “It feels better to have someone direct me than to direct myself.” Participant 4 reported having preferred the nondirective coaching phase and stated it was, “easier to set attainable goals. We would discuss the ways I could get active minutes.”
CHAPTER 4: DISCUSSION

Health coaching shares common components with effective interventions for increasing physical activity in applied behavior analysis, but the nondirective approach taken by health coaches differs from the more directive approach taken by behavior analysts. The present study attempted to evaluate, in a single case design, an extreme version of the nondirective coaching approach commonly used in health coaching, to learn about the effects of this broad approach on physical activity at an individual level, followed by the introduction of a directive coaching approach to learn about the relative effects of an approach more common in applied behavior analysis. We observed an increase in the level of daily active zone minutes at the introduction of both nondirective coaching and directive coaching for one of four participants; however, without replication across other participants, there was no demonstration of experimental control. We did not observe meaningful changes in secondary measures of physical activity (i.e., steps, calories expended, distance) for any participants. Adherence to the intervention as measured by days wearing the Fitbit, days submitting physical activity metrics to the experimenter, and attendance at weekly virtual meetings was high across all phases for all participants. Self-reported preference for type of coaching varied across participants, with one participant (Participant 4) reporting a preference for nondirective coaching over directive coaching, two participants (Participants 2 and 3) reporting a preference for directive coaching over nondirective coaching, and one participant (Participant 1) reporting liking both approaches equally. Only one participant (Participant 2) opted into the additional week of participation in the study, and they chose the directive coaching style, consistent with their reported preference for the directive approach over the nondirective approach. In summary, we did not observe reliable effects of
either approach on physical activity, and reported preference for coaching styles varied across participants.

The failure to demonstrate experimental control with respect to the introduction of nondirective and directive coaching in the present study departs from results of prior similar studies (e.g., Donaldson & Normand, 2009; Normand, 2008; Valbuena et al., 2015; VanWormer, 2004). We have identified the following as potential contributing factors to the different outcomes. First, the study was conducted during the COVID-19 pandemic. Pandemic-related precautions limited the accessibility of gyms, schools, workplaces, and other public settings and limited face-to-face social interaction. Participants reported pandemic-related lifestyle changes during coaching sessions (e.g., limited or lack of gym access, inability to exercise in-person with friends). Additionally, and related, is the telehealth mode of delivery of all intervention components in the present study. Fitbits were delivered by mail or contactless drop-off, screening and coaching sessions were held remotely via Zoom, and all other communications were made by email or text. This differs from Normand (2008) and Donaldson and Normand (2009) which both incorporated face-to-face meetings with participants. On the other hand, VanWormer (2004) and Valbuena et al. (2015) both delivered coaching components virtually (by email and video meetings, respectively) and both demonstrated increases in step count across all participants. It is unclear whether the mode of delivery of coaching interventions for physical activity influences their effectiveness, and future research might evaluate this variable.

An additional difference between the present study and previous similar coaching interventions for physical activity, which may have contributed to the different outcomes, concerns the age of participants. The participants in the present study ranged from 19-22 years of age, whereas participants of comparable coaching interventions for increasing physical
activity in the applied behavior analytic literature (i.e., Donaldson and Normand, 2009; Normand, 2008; Valbuena et al., 2015; VanWormer, 2004) ranged in age from 32-59 years. It may be the case that age-related differences account for different results of similar interventions for young adult college students and adult participants.

The use of active zone minutes as a primary dependent measure differs from VanWormer (2004), Normand (2008), and Valbuena et al. (2015), who used daily steps as their primary dependent measure and weight as a secondary dependent measure, and from Donaldson and Normand (2009), who used daily calorie expenditure as their primary dependent measure and BMI and weight as secondary measures. It may be the case that active zone minutes are harder to influence than steps or calories. For example, it may require more response effort to raise the heart rate into the minimum range to achieve active zone minutes (i.e., the fat burn zone) than it does to achieve steps or expend calories. Furthermore, it may be the case that participants are less familiar with active zone minutes and the activities that produce them. However, if this were the case, we might expect little to no change in active zone minutes during nondirective coaching, followed by change in active zone minutes during directive coaching as participants received information on how active zone minutes are defined and achieved. This was not the case; rather, active zone minutes changed for only one participant (Participant 1), and active zone minutes changed in both the nondirective and directive coaching phases for that participant. The varied dependent variables in the nondirective coaching phase make it challenging to speculate on the influence of active zone minutes as a dependent variable in this study. Future research might select active zone minutes as a primary dependent measure in future coaching interventions for physical activity to gain a better understanding of its use as a dependent
measure in this context or compare the use of active zone minutes to other commonly used dependent measures, such as step count.

The use of active zone minutes as a dependent measure might also be considered a potential strength of the present study, as active zone minutes are able to capture a variety of physical activities in which participants engaged, as opposed to step count which was used in much of the recent physical activity research (e.g., Andrade et al., 2014; Ek et al., 2016; Galbraith & Normand, 2017; Hayes & Van Camp, 2015; Hustyi et al., 2011; Kuhl et al., 2015; Kurti & Dallery, 2013; Li et al., 2018; Miller et al., 2018; Normand, 2008; Valbuena et al., 2015; Van Camp & Berth, 2018; VanWormer, 2004; Washington et al., 2014; Zerger et al., 2017). For example, participants in the present study reported that they engaged in a wide variety of physical activities (e.g., walking, hiking, swimming, high intensity interval training (HIIT), yoga), and active zone minutes may have been able to capture activity that other measures would not have (e.g., step count with respect to swimming). Additionally, active zone minutes may be a clinically relevant measure of physical activity, given their utility as a measure of moderate intensity physical activity. There is a lack of research with respect to the reliability and validity of active zone minutes (tracked by the Fitbit Versa, Sense, Luxe, Ionic, Inspire 2, Charge 4, and Charge 5). However, research with respect to the reliability of active minutes as measured by earlier Fitbit models suggest that Fitbits tend to produce more valid measurements of step count compared to active minutes (Feehan et al., 2018; Reid et al., 2017). Fitbit devices tend to overestimate active minutes in free-living conditions (Alharbi et al., 2016; Brewer et al., 2017; Diaz et al., 2015; Schneider & Chau, 2016). However, Brewer et al. (2017) found that the Fitbit devices tended to produce more valid measurements of active minutes over seven days as opposed to a one-day period. Additionally, although not always accurate, measurements of
active minutes produced by Fitbit devices appear to be reliable (Diaz et al., 2015). Given its accessibility, feasibility, and reliability, the Fitbit may still be considered a reasonable alternative to research-grade devices (e.g., Actigraph) for estimating activity in free-living conditions (Alharbi et al., 2016; Brewer et al., 2017; Diaz et al., 2015; Schneider & Chau, 2016).

In addition to considering differences between prior similar studies and the present study, it is worth considering differences between Participant 1, for whom the nondirective and directive coaching interventions may have influenced physical activity, and Participants 2-4, whose physical activity remained relatively unchanged over the course of the study. One such difference concerns the length of baseline for each participant. Participant 1 remained in baseline for the shortest duration (i.e., 23 days) compared to other participants (i.e., 34-59 days). Furthermore, approximately one week passed for all participants between the initial screening meeting and the baseline session to set up the Fitbit, further lengthening the time between enrollment in the study and the beginning of coaching sessions. Events which were functioning as establishing operations for participation in the study for Participant 1 at the time of enrollment may have remained in effect at the time coaching was introduced; whereas events which were functioning as establishing operations for participation in the study for Participants 2-4 may have no longer been in effect by the time coaching was introduced. Future research seeking to evaluate coaching interventions for physical activity might make changes to the present design to address this potential concern (e.g., shorten participant baselines, use nondirective coaching as a baseline phase and subsequently move to directive coaching when data are stable).

In some ways, our nondirective health coaching phase lacked ecological validity with respect to health coaching in practice, which may have contributed to the lack of effects. For example, health coaching practice does not typically target only physical activity, but instead
involves a variety of health-related behaviors, such as sleep, diet, and physical activity. Additionally, consumers of health coaching services are paying for the service. Although our participants were motivated enough to sign up for this study, they were not paying for coaching, and we might have seen different results if they had been. Although a mock nondirective coaching session received favorable ratings from a certified health coach prior to the start of the study, it would be preferred to have certified health coaches look at recorded study sessions and blindly rate both nondirective and directive sessions. Such data would strengthen confidence in the ecological validity of the nondirective health coaching intervention, especially given the lack of reliable effects observed with the introduction of nondirective coaching.

In addition to failing to demonstrate a reliable change in physical activity from baseline to nondirective coaching, we failed to demonstrate a reliable change in activity with the subsequent introduction of directive coaching. This study does not permit a comparison of nondirective and directive coaching approaches; rather, it evaluated the effects of providing nondirective coaching and introducing a directive coaching approach after some time. It is important to highlight that these coaching strategies were presented back-to-back, and always nondirective prior to directive coaching. The lack of difference in physical activity between nondirective coaching and directive coaching for participants 2-4 may be due, in part, to sequence effects because of always presenting conditions in this way. Future studies might consider a more thorough evaluation of the effects of these coaching approaches alone and back-to-back by presenting conditions in the reverse order for some participants, as well as in isolation for others.

We attempted to evaluate two broad, often loosely defined treatment approaches, so our independent variables were expected to vary somewhat from person to person, despite designing
them to differ, overall, in important ways from one another. We evaluated extreme and purposefully rigid ends of the coaching spectrum (directive and nondirective) to distinguish our conditions. In practice, however, a combination of nondirective and directive approaches may be best and may be more typical. Nondirective and directive approaches are not necessarily incompatible, and the most desirable or most effective approach may be somewhere in between. For example, when asked to report which approach they preferred at the conclusion of their involvement in the study, Participant 1 selected both nondirective and directive coaching approaches. Participant 1 said, “I think the coach should set the goal, but there should be more discussion about how the participant can improve their levels and reach the goals. Both parts were equally as necessary.” Future studies may evaluate various combinations of nondirective and directive coaching components.

The nature of package interventions is such that when we do see potential intervention effects, as in the case of Participant 1, we do not know which components were necessary to produce the observed effects. However, because the performance of Participant 1 corresponded so closely to the goals in place at a given time, we suspect that the goals in place in both nondirective and directive coaching approaches exerted some control over behavior. In the current study, praise was the sole contrived consequence for meeting a goal, and there may have been a lack of differential consequences for meeting versus failing to meet a goal in both the nondirective and directive coaching phases, contributing to a lack of change in physical activity for Participants 2-4. Additionally, the delivery of praise was delayed with respect to physical activity, and the opportunity for its delivery was infrequent (approximately once per week). A conclusion from this study may be that we need to increase the value and/or frequency of the consequences for meeting a goal for some participants. For example, future studies might add
additional contrived consequences for meeting a goal (e.g., monetary consequences; Kurti & Dallery, 2013) for participants who do not respond to coaching alone, or program more frequent feedback (e.g., daily texts in response to self-monitoring messages sent by participants).

There has been no evaluation of the effects of nondirective and directive treatment in the context of coaching to increase physical activity, at least to our knowledge. Outside of the context of physical activity, attempts have been made to compare client-centered approaches to more directive behavior-change interventions (e.g., Alper & Kranzler, 1970; Andrews, 1971; Duncombe et al., 2016; Holen & Kinsey, 1975), and to applied behavior analysis interventions (Bernal et al., 1980; Marlowe et al, 1978). These comparisons are limited in number and have produced mixed results (e.g., Bernal et al., 1980; Marlowe et al, 1978). For example, Marlowe et al. (1978) compared behavioral counseling to client-centered counseling to decrease the inappropriate classroom behavior of elementary-school students. Results indicated that the behavioral counseling was effective in reducing challenging classroom behavior, whereas the client-centered counseling did not produce behavior change (Marlowe et al., 1978). On the other hand, Bernal et al. (1980) compared parent training in behavior management skills to client-centered parent counseling for decreasing the challenging behaviors of children and found no difference in child behavior between the two groups as observed by experimenters. It is notable, though, that parents who had received behavioral parent training self-reported significantly greater improvement in their children’s behavior, on average, than the parents who had received client-centered counseling. The present study adds to the mixed results of prior comparisons of client-centered and directive approaches in other contexts. In the present study, the addition of directive coaching did not produce effects compared to nondirective coaching alone, and reported preference for coaching type varied across participants.
Despite not observing reliable effects of nondirective or directive coaching across participants, the present study involved a single case evaluation of health coaching that improved on some of the methodological limitations of the existing research base. For the most part, the health coaching literature rarely reports direct measures of the behavior(s) of interest, and no studies have used experimental designs that allow for an evaluation of treatment effects at the individual level (Kivela et al., 2014; Lindner et al., 2003; Olsen & Nesbitt, 2010; Simmons & Wolever, 2011; Wolever et al., 2013). This study provided a single case evaluation of the effects of nondirective health coaching intervention and used permanent product recording of active zone minutes by the Fitbit as a direct measure of physical activity. In this way, the present study provided a model for a way applied behavior analysis can contribute to health coaching through the application of within-subject methods and reliable measures for strong evaluations of intervention effects at the individual level. It may also provide a model of how health coaches could evaluate their own practice. Results like ours would tell a health coach in real time whether meaningful changes in activity were occurring for the majority of their clients, so changes in their coaching approach could be made, if warranted.

In summary, we failed to demonstrate experimental control with respect to the introduction of nondirective coaching or the subsequent introduction of directive coaching, and reported preference for coaching style varied across participants. Our results depart from those of prior similar studies (e.g., Donaldson & Normand, 2009; Normand, 2008; Valbuena et al., 2015; VanWormer, 2004). Potential contributing factors to the different outcomes include, but are not limited to, effects of the COVID-19 pandemic, the telehealth mode of delivery, a young adult college-student population, active zone minutes as a primary dependent measure, long baselines for some participants, a lack of ecological validity with respect to health coaching,
sequence effects, and a lack of differential consequences for meeting versus failing to meet goals. Despite the lack of experimental control, the present study may provide a way in which health coaches might evaluate their practice. Future research might replicate the current procedures in the absence of pandemic-related restrictions, evaluate mode of delivery of coaching interventions (e.g., telehealth, face-to-face), recruit participants with a more varied age range, replicate coaching interventions using active zone minutes as a dependent variable, lessen the length of baseline, vary the sequence of coaching phases, or add contingency management.
REFERENCES


Brewer, W., Swanson, B. T., & Ortiz, A. (2017). Validity of Fitbit’s active minutes as compared with a research-grade accelerometer and self-reported measures. *BMJ Open Sport & Exercise Medicine, 3*, 1-7. https://doi.org/10.1136/bmjsem-2017-000254


https://doi.org/10.1002/bin.1518


https://doi.org/10.7453/gahmj.2013.042


https://apps.who.int/iris/bitstream/handle/10665/44399/9789241599979_eng.pdf;jsessionid=2DB61B7278AF21D8D4C230D0C21E5E43?sequence=1


https://apps.who.int/iris/bitstream/handle/10665/148114/9789241564854_eng.pdf;jsessionid=2E509689391B2F74E82EDB0A39917DBA?sequence=1


### Table 1
*Condition Comparison Table*

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Nondirective Health Coaching</th>
<th>Directive Coaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant wears the</td>
<td>Participant wears the Fitbit daily</td>
<td>Participant wears the Fitbit daily</td>
<td>Participant wears the Fitbit daily</td>
</tr>
<tr>
<td>Fitbit daily</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participant has access</td>
<td>Participant has access to the Fitbit account</td>
<td>Participant has access to the Fitbit account and</td>
<td>Participant has access to the Fitbit account and sends <em>active zone minute total</em> to experimenter daily</td>
</tr>
<tr>
<td>to the Fitbit account</td>
<td>and sends <em>all physical activity metrics</em> to</td>
<td>sends <em>all physical activity metrics</em> to experimenter daily</td>
<td></td>
</tr>
<tr>
<td>and sends <em>all physical</em></td>
<td>experimenter daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>activity metrics* to</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>experimenter daily</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participant meets with</td>
<td>Participant meets with experimenter for 30-minute</td>
<td>Participant meets with experimenter for 30-minute</td>
<td></td>
</tr>
<tr>
<td>experimenter for 30-minute</td>
<td>1x/week</td>
<td>minutes sessions 1x/week</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Motivational interviewing during session</td>
<td>Review graphed data during session</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mostly <em>participant</em> speaking</td>
<td>Mostly <em>experimenter</em> speaking</td>
<td></td>
</tr>
<tr>
<td>The <em>participant sets their own</em></td>
<td>The experimenter sets the participant’s goals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>goals. The experimenter</td>
<td>supports the participant’s development of SMART goals</td>
<td>using the percentile schedule</td>
<td></td>
</tr>
<tr>
<td>The experimenter provides</td>
<td></td>
<td>The experimenter provides praise for the participant meeting their goal, or encouragement for failing to meet goal</td>
<td></td>
</tr>
<tr>
<td>praise for the participant meeting their goal, or encouragement for failing to meet goal</td>
<td></td>
<td>The experimenter gives health info to the participant (<em>stressing its importance and rationale</em>)</td>
<td></td>
</tr>
<tr>
<td>The experimenter offers</td>
<td></td>
<td>The experimenter offers relevant health info to the participant if they want to know more (<em>general recommendations and links to info</em>)</td>
<td></td>
</tr>
<tr>
<td>relevant health info to</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>the participant if they want to</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>know more (<em>general recommendations and links to info</em>)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topic</td>
<td>Source(s)</td>
<td>Link(s)</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------------------</td>
<td>-------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Physical Activity Recommendations</td>
<td>World Health Organization (WHO)</td>
<td><a href="https://www.who.int/news-room/fact-sheets/detail/physical-activity">https://www.who.int/news-room/fact-sheets/detail/physical-activity</a></td>
<td></td>
</tr>
<tr>
<td>Physical Activity Benefits</td>
<td>WHO</td>
<td><a href="https://www.who.int/news-room/fact-sheets/detail/physical-activity">https://www.who.int/news-room/fact-sheets/detail/physical-activity</a></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><a href="https://blog.fitbit.com/active-zone-minutes/">https://blog.fitbit.com/active-zone-minutes/</a></td>
<td></td>
</tr>
</tbody>
</table>
Table 3

Percent Nonoverlapping Data Across Phases

<table>
<thead>
<tr>
<th>Participant</th>
<th>Nondirective to Baseline</th>
<th>Directive to Nondirective</th>
<th>Directive to Baseline</th>
<th>Optional Week to Baseline</th>
<th>Optional Week to Nondirective</th>
<th>Optional Week to Directive</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>35.00%</td>
<td>7.14%</td>
<td>64.29%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2</td>
<td>0.00%</td>
<td>10.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>P3</td>
<td>0.00%</td>
<td>8.70%</td>
<td>4.35%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P4</td>
<td>0.00%</td>
<td>10.00%</td>
<td>0.00%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. PND was calculated by dividing the number of data points that fall above the highest value in the comparison phase by the total number of data points in the comparison phase and multiplying by 100 (Scruggs et al., 1987).
Table 4
*Treatment Integrity Analysis*

<table>
<thead>
<tr>
<th></th>
<th>Nondirective Coaching (n=4)</th>
<th>Directive Coaching (n=5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Range</td>
</tr>
<tr>
<td>Percent Speaking Time</td>
<td>50%</td>
<td>43-56%</td>
</tr>
<tr>
<td>Participant Speaking</td>
<td>50%</td>
<td>44-57%</td>
</tr>
<tr>
<td>Percent Speaking Time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coach Speaking</td>
<td>13.5</td>
<td>11-15</td>
</tr>
<tr>
<td>Open-Ended Questions by Coach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graph Reviewed</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Health Resources Shared</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Goal Set by Participant</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Goal Set by Coach</td>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>
Table 5  
*Weekly Goals During Nondirective and Directive Coaching*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Week</th>
<th>Nondirective Coaching</th>
<th>Directive Coaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>1</td>
<td>30 active min on 7/7 days</td>
<td>58 active min on 5/7 days</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>30 active min on 7/7 days</td>
<td>58 active min on 5/7 days</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>30 active min on 7/7 days</td>
<td>58 active min on 5/7 days</td>
</tr>
<tr>
<td>P2</td>
<td>1</td>
<td>5,000 steps on 7/7 days</td>
<td>44 active min on 5/7 days</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>5,000 steps on 7/7 days</td>
<td>44 active min on 5/7 days</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>6,000 steps on 6/7 days</td>
<td>44 active min on 5/7 days</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>6,000 steps on 6/7 days</td>
<td>44 active min on 5/7 days</td>
</tr>
<tr>
<td>P3</td>
<td>1</td>
<td>10,000 steps, 20 active min, 5 miles, <em>and</em> 2,000 calories on 7/7 days</td>
<td>3 active min on 5/7 days</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3 of the following: 10,000 steps, 20 active min, 5 miles, <em>or</em> 2,000 calories on 6/7 days</td>
<td>3 active min on 5/7 days</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>10,000 steps <em>and</em> 2,000 calories on 4/7 days</td>
<td>3 active min on 5/7 days</td>
</tr>
<tr>
<td>P4</td>
<td>1</td>
<td>15 active min on 7/7 days</td>
<td>52 active min on 5/7 days</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>30 active min on 7/7 days</td>
<td>52 active min on 5/7 days</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>30 active min on 6/7 days</td>
<td>52 active min on 5/7 days</td>
</tr>
</tbody>
</table>
Table 6
*Participants’ Preference for Coaching Style*

<table>
<thead>
<tr>
<th>Participant</th>
<th>Nondirective Coaching</th>
<th>Directive Coaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>P2</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>P3</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>P4</td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>
Figure 1. Demographic characteristics of participants.
Figure 2. Percent of speaking time during which the participant and coach were speaking.
Figure 3. Multiple baseline across participants display of total active zone minutes per day.
Figure 4. Multiple baseline across participants display of 7-day moving average of daily active zone minutes.
Figure 5. Active zone minutes, steps, miles traveled, and calories expended per day of Participant 1.
Figure 6. Active zone minutes, steps, miles traveled, and calories expended per day of Participant 2.
Figure 7. Active zone minutes, steps, miles traveled, and calories expended per day of Participant 3.
Figure 8. Active zone minutes, steps, miles traveled, and calories expended per day of Participant 4.
Figure 9. Endorsement of social validity statements for nondirective coaching sessions.
**Figure 10.** Endorsement of social validity statements for directive coaching sessions.
Figure 11. Endorsement of social validity statements for nondirective and directive coaching sessions by Participant 1.
Figure 12. Endorsement of social validity statements for nondirective and directive coaching sessions by Participant 2.
Figure 13. Endorsement of social validity statements for nondirective and directive coaching sessions by Participant 3.
Figure 14. Endorsement of social validity statements for nondirective and directive coaching sessions by Participant 4.
APPENDIX C: RECRUITMENT FLYER

PHYSICAL ACTIVITY RESEARCH STUDY

DO YOU WANT TO BE MORE ACTIVE?

VOLUNTEERS NEEDED

Partner with the Department of Psychology to increase your physical activity in a one-to-three month study involving weekly video calls and a Fitbit tracker.

YOU MAY QUALIFY IF YOU:
• ARE 18-55 YEARS OLD
• HAVE INTERNET ACCESS AND AN ELECTRONIC DEVICE
• ARE ABLE TO SAFELY ENGAGE IN PHYSICAL ACTIVITY

IF INTERESTED, CONTACT:
HAILEY DONOHUE, H_DONOHUE@U.PACIFIC.EDU
(906)250-2021
APPENDIX D: CONSENT FORM

UNIVERSITY OF THE PACIFIC

RESEARCH SUBJECT’S CONSENT TO PARTICIPATE IN RESEARCH
Evaluating a Client-Centered Health Coaching Package and a Directive Coaching Package for Increasing Physical Activity

Name of Lead Researcher: Hailey Donohue
Name of Faculty Advisor: Dr. Matthew Normand

You are being invited to participate in a research study, and your participation is entirely voluntary.

A. Purpose of Research. The purpose of this research is to examine the effects of two styles of coaching on the physical activity level of adults. It is expected that the information gained from this study will provide important information about the behavioral changes resulting from the intervention. This information will aid in the development of better interventions to improve the health and fitness of adults.

B. Duration of Participation. You will be involved in the study for a total range of 5-14 weeks. During this time, you will be involved in one baseline meeting, followed by 4-9 total coaching sessions, for a total of 5-10 total approximately 30-min Zoom contacts with the experimenter (i.e., 2.5-5 hours total).

C. Research Procedures. A Fitbit Inspire 2 fitness tracker will be provided to you at the start of the study by mail or contactless drop-off. If you decide to participate, you will be asked to 1) wear the fitness tracker each day and email or text Fitbit metrics to the experimenter daily for a period of 5-14 weeks, 2) meet with a health coach by video call on a weekly basis for approximately 30-min at a time for a range of 5-9 consecutive weeks, and 3) complete a number of questionnaires. Across coaching sessions, you will guide discussion and set your own physical activity goals with support and feedback from the coach during 2-4 sessions. The experimenter will guide sessions, set physical activity goals for you, and provide feedback during an additional 2-4 sessions. If you currently use a fitness tracker, you will be asked to use only the tracker provided by the experimenter for the duration of the study.

D. Foreseeable Risks. There are some possible risks involved for participants. You may experience discomfort over the course of the study if your physical activity goals are not met.

Additionally, there will be minimal physical risk posed as a product of increased or novel forms of physical activity. The University of the Pacific is not responsible in the event of a research related injury. By agreeing to participate in this study, you agree to assume full responsibility for any injuries which might occur as a result of increased physical activity. If a medical incident occurs, please contact your usual medical provider.
Although not anticipated, it is possible that a loss of confidentiality may occur during data collection and as researchers share information about the sessions.

E. **Benefits.** There are some benefits to this research, and in particular the benefits may include weekly coaching sessions at no cost to you, and you will be allowed to keep the Fitbit Inspire 2 device at the conclusion of the study. You can reasonably expect to see increases in physical activity.

F. **Alternative to Participation.** You do not have to participate in this study, and if you choose to begin this study, you can stop at any time if you do not want to continue.

I. **CONFIDENTIALITY**
Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission. The information collected will be used for research purposes only.

We will take reasonable steps to keep confidential any information that is obtained in connection with this research study and can be identified with you.

Measures to protect your confidentiality are storing session recordings on a University-issued computer, shared between researchers using a secure server.

Upon conclusion of the research study, the data obtained will be maintained on a secure server and will be destroyed after a period of seven years after the research is completed.

II. **PARTICIPATION**
You were selected as a possible participant in this study because you are between the ages of 18-55, you are interested in increasing your level of physical activity, Your decision whether or not to participate will involve no penalty or loss of benefits to which you are otherwise entitled. If you decide to participate, you are free to discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled.

III. **EXPERIMENTAL PROCEDURES**
No experimental procedures will be used in this study.

IV. **COLLECTION OF INFORMATION OR BIOSPECIMENS**
Identifiers will be removed from the identifiable private information, and such information will not be used or distributed for future research studies.

V. **UNIVERSITY CONTACT INFORMATION**
I am the lead researcher in this study and I am a graduate student in the Department of Psychology at the University of the Pacific. This research study is part of my thesis for my Master’s in behavioral psychology.
If you have any questions about the research at any time, please contact the principal investigator, Hailey Donohue, at 906-250-2021, or h_donohue@u.pacific.edu. You may also contact the faculty advisor, Matthew Normand, at 209-946-7317, or mnormand@pacific.edu.

If you have any questions about your rights as a participant in a research project or wish to speak with an independent contact, please call the Office of Research & Sponsored Programs, University of the Pacific at (209)946-3909 or by email at IRB@pacific.edu.

VI. COMPENSATION
You will be offered possession of the Fitbit Inspire 2 at the completion of your participation in all phases of the study (approximately 9 weeks on average).

VII. ACKNOWLEDGEMENT AND SIGNATURE
I hereby consent: (Indicate Yes or No)
• To be video recorded during this study.
  ___Yes ___No
• For such video recordings from this study to be used to evaluate the degree to which sessions were conducted accurately.
  ___Yes ___No
• For my identity to be disclosed in written materials resulting from this study.
  ___Yes ___No

You will be given a copy of this form to keep.

Your signature below indicates that you have read and understand the information provided above, that you have been afforded the opportunity to ask, and have answered, any questions that you may have, that your participation is completely voluntary, that you understand that you may withdraw your consent and discontinue participation at any time without penalty or loss of benefits to which you are otherwise entitled, that you will receive a copy of this form, and that you are not waiving any legal claims, rights or remedies.

Signed: ________________________ Date: ___________________________
Research Study Participant (Print Name): ______________________________
Researcher Who Obtained Consent (Print Name): _________________________
APPENDIX E: PHYSICAL ACTIVITY READINESS QUESTIONNAIRE

Figure 10-3
The Physical Activity Readiness Questionnaire

©2000 Used with permission from the Canadian Society for Exercise Physiology, www.csep.ca
The following questions are designed to identify how you personally feel about your physical activity right now. Please think about your current situation and levels of inactivity, even if you have become physically active. Read each question below carefully and then decide whether you agree or disagree with the statements.

**Key:**
- **SD:** Strongly disagree
- **D:** Disagree
- **U:** Unsure
- **A:** Agree
- **SA:** Strongly agree

<table>
<thead>
<tr>
<th>Item</th>
<th>Question</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>It’s a waste of time thinking about my physical activity, because I do not have a problem.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I enjoy inactivity, but sometimes I am too sedentary.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>There is nothing seriously wrong with my current levels of physical activity.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Sometimes I think I should become more active.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Anyone can talk about wanting to do something about their physical activity, but I’m actually doing something about it.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>I am fairly normal in terms of physical activity.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>My level of physical activity is a problem sometimes.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>I am actually changing my activity habits right now (either beginning to be active or increasing my activity).</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>I have started to carry out a plan to increase my physical activity.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>There is nothing I really need to change about my physical activity.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Sometimes I wonder if my physical activity is a problem.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>I am actively working on changing my physical activity.</td>
<td></td>
</tr>
</tbody>
</table>

**Scoring the Readiness to Change Questionnaire (Treatment Version)**
Items numbered 1,3,6,10 = Precontemplation, items numbered 2,4,7,11 = Contemplation, items numbered 5,8,9,12 = Action. All items should be scored on a 5-point scale ranging from:

- **-2:** Strongly disagree
- **-1** Disagree
- **0** Unsure
- **+1** Agree
- **+2** Strongly agree

To calculate the score for each scale, simply add the item scores for the scale in question. The range of each scale is -8 through +8. A negative scale score reflects an overall disagreement with items measuring the stage of change, whereas a positive score represents overall agreement. The highest scale score represents the Stage of Change Designation. Note: If two or more scale scores are equal, then the scale farthest along the continuum of change (Precontemplation-Contemplation-Action) represents the subject’s Stage of Change Designation. For example, if a subject scores 6 on the Precontemplation scale, 6 on the Contemplation scale and -2 on the Action scale, then the subject is assigned to the Contemplation stage.

If one of the four items on a scale is missing, the subject’s score for that scale should be pro-rated (i.e. multiplied by 4/3 or 1.33). If two or more items are missing, the scale score cannot be calculated. In this case the Stage of Change Designation will be invalid.
1. What is your age in years?
   I prefer to not answer.

2. Which categories describe you? Select all that apply:
   White
   Black or African American
   American Indian or Alaska Native
   Asian Indian
   Chinese
   Filipino
   Other Asian (for example, Hmong, Laotian, Thai, Pakistani, Cambodian)
   Vietnamese
   Korean
   Japanese
   Native Hawaiian
   Guamanian or Chamorro
   Samoan
   Other Pacific Islander (for example, Fijian, Tongan)
   Other race. Please specify:
   I prefer to not answer.

3. Are you of Hispanic, Latino, or Spanish Origin?
   No, not of Hispanic, Latino, or Spanish origin
   Yes, Mexican, Mexican American, Chicano
   Yes, Puerto Rican
   Yes, Cuban
   Yes, another Hispanic, Latino, or Spanish origin. Please specify (for example, Argentinean, Colombian, Dominican, Nicaraguan, Salvadoran, Spaniard):
   I prefer to not answer.

4. How do you currently describe your gender identity?
Please specify:
I prefer to not answer.

5. What is your sex?
   Male
   Female
   I prefer to not answer.

6. What is the highest level of school you have completed? Select one. If currently enrolled, mark the previous grade or highest degree received.
   High school diploma or equivalent (e.g., GED)
   Some college, no degree
   Associate’s degree
   Bachelor’s degree
   Master’s degree (e.g., MA, MS, Meng, Med, MSW, MBA)
   Professional degree beyond a bachelor’s degree (e.g., EdS, MD, DDS, JD)
   Doctorate degree (e.g., EdD, PhD)
   Other (please specify):
   I prefer to not answer.

7. What is your marital status?
   Now married
   Widowed
   Divorced
   Separated
   Never married
   I prefer to not answer.

8. What is your current employment status? Select all that apply:
   Part-time employment (20 or fewer hours/week)
   Part-time employment (21-34 hours/week)
   Full-time employment (35-49 hours/week)
   Full-time employment (50+ hours/week)
   Unemployed
   Retired
Student

Other (please specify):

I prefer not to answer.

9. Do you currently use a pedometer or other monitor of physical activity?

Yes

If so, please specify which one(s):

If so, please specify which features:

If so, please specify how often (for example, twice per day, once per day, once per week, once or twice per month):

No

10. Have you ever used a pedometer or other monitor of physical activity?

Yes

If so, please specify which one(s):

If so, please specify which features:

If so, please specify how often (for example, twice per day, once per day, once per week, once or twice per month):

If so, please specify when you last used the device (for example, approximately three months ago, two years ago):

No
• What would your life look like if you were as active as you want to be?

• Have there been times when you were as active as you want to be?
  o What was it like? What was different about that time?

• What would you have to do to get you back to this time?

• On a scale from 1 to 10, with 1 being the worst it has ever been, and 10 being the best things could be, where would you rate things today? Why?
  o What would a [next highest number] look like?
  o What would a [next lowest number] look like?

It can be hard to consider all angles when we are thinking of making a change. Thinking about all of the pros and cons of changing and of not changing can be helpful for considering all the reasons for making a change. First, we are going to talk about the pros of staying the same, then the cons of staying the same, followed by the cons of changing, and finally, the pros of changing.

<table>
<thead>
<tr>
<th>Positives of Staying the Same</th>
<th>Negatives of Staying the Same</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Negatives of Changing</th>
<th>Positives of Changing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX I: EXAMPLE NONDIRECTIVE HEALTH COACHING SESSION
FLOWCHART

Share the participant's step count relative to their goal in the previous week

Met goal: 
Praise statement

Didn't meet goal: Encouragement

Motivational interview: discuss barriers and possible solutions to meeting goals

Motivational interview: discuss barriers and possible solutions to meeting goals

Set goal for the next week
Coach: Last week you expressed that you wanted to take 7,000 steps/day on average. You didn’t hit that mark. How do you feel about that?

Participant: I’m bummed that I didn’t reach that goal and frustrated because I’m working so hard at it.

C: You are putting in a lot of work! What about that has gone well since we talked last?

P: I’ve definitely been more focused on my physical activity throughout the week and I notice myself thinking about it more often.

C: You’ve been giving this goal a lot of thought. What has been challenging about working toward your goal since we talked last?

P: I thought I was doing so well, but my average was a lot lower than I expected it to be.

C: You felt like what you were doing and the results didn’t quite match up. What would you prefer had happened instead?

P: I wish that after working harder at it this week, that I had hit that goal.

C: What would it mean to you to make that happen?

P: It would be really nice to know that when I focused on something and tried really hard, that I can accomplish the things I want to do.

C: What small changes are you ready to make that might bring your hard work closer to producing your goal?

P: I think I could try to spread out my activity more instead of pushing myself really hard a couple of times so I don’t feel so tired out.

C: So, spreading your activity times into smaller, more frequent bouts seems like a feasible change for you right now. What has helped you make changes in the past?

P: Telling my friends and family has helped me stay focused on follow through on things before.

C: Sharing your goals with others has helped in your past. Who can support your efforts to do that now?
**P:** I see my roommate the most, so I might be able to share my goals with her.

**C:** Great, so you’re around your roommate a lot and could vocalize your goals to her throughout the week. What feels like a next step you might take?

**P:** I will tell my roommate what my step goal is for the week, and I’ll talk to her more about what I’m doing for physical activity during the week.

**C:** You’ve identified something that has been helpful in the past, talking to people around you about your goals, and how you could do that now as you work toward this goal. What have learned as we’ve talked today?

**P:** I’ve realized I want to try taking smaller steps to increase my activity, and talk to my roommate about it to try to keep myself more accountable.

**C:** Great! That sounds like an excellent plan. Have you given thought to how many steps per day on average you’d like to accomplish this week?

**P:** I will stick with 7,000/day on average, and I will try out those new strategies.

**C:** Wonderful. I look forward to chatting about how that went together next week.

---

### Qualitative Praise Statements and Encouragement Statements

<table>
<thead>
<tr>
<th>Praise Statements</th>
<th>Encouragement Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Participant met their step-count goal</strong></td>
<td><strong>Participant did not meet their step-count goal</strong></td>
</tr>
<tr>
<td>You met your step count goal from last week!</td>
<td>You didn’t meet your step count goal from last week. Let’s work hard and give it another go this week.</td>
</tr>
<tr>
<td>Awesome job.</td>
<td></td>
</tr>
<tr>
<td>Last week you expressed wanting to increase your steps taken. You did that! How do you feel?</td>
<td>Last week you expressed wanting to increase your steps/day, on average. Your average steps/day decreased this week. How do you feel?</td>
</tr>
<tr>
<td>You took more steps per day on average last week than your goal! What were some things that worked well for you this week?</td>
<td>You took less steps per day on average than your weekly goal. What were some things that might have made that difficult?</td>
</tr>
<tr>
<td>You achieved the goal you set for yourself last week! Keep doing what you’re doing.</td>
<td>You didn’t reach the goal you set for yourself last week. What can be done differently this week?</td>
</tr>
<tr>
<td>You met your weekly goal, great work. What are some things that made that easier for you?</td>
<td>You didn’t meet your weekly goal. Let’s try again this week. What are some things that might make that easier?</td>
</tr>
</tbody>
</table>
## APPENDIX K: EXAMPLE USE OF THE PERCENTILE SCHEDULE

<table>
<thead>
<tr>
<th>Phase</th>
<th>Week</th>
<th>Day</th>
<th>Active Zone Minutes</th>
<th>Weekly Goal Using the Percentile Schedule</th>
<th>Goal Met (Y/N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nondirective Health</td>
<td>3</td>
<td>15</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coaching</td>
<td>16</td>
<td>14</td>
<td></td>
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<td></td>
<td>17</td>
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<td>Directive Health</td>
<td>4</td>
<td>22</td>
<td>22</td>
<td>13</td>
<td>Y</td>
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<tr>
<td>Coaching</td>
<td>23</td>
<td>15</td>
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<td>6</td>
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<td>23</td>
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<td>Y</td>
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<td></td>
<td>42</td>
<td>26</td>
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</tr>
</tbody>
</table>
APPENDIX L: EXAMPLE DIRECTIVE COACHING FLOWCHART

1. Share the participant's active zone minutes relative to their goal in the previous week and visually analyze the graphed data together.
   - Met goal: Praise statement
   - Didn't meet goal: Encouragement

2. Share health info and rationale for increasing physical activity

3. Share the participant's next weekly goal
Coach: Last week I gave you a goal of 32 active zone minutes per day on 5 of 7 days. You didn’t hit that mark. You achieved at least 32 active zone minutes on 3 of 7 days last week, just 2 days short of your goal. This week I’d like to review a graph of this information together.

We’re looking at a graph of your total active zone minutes logged each day. Each point represents the total number of active zone minutes you achieved per day, starting with your first day wearing the Fitbit all the way on the left, and your most recent day all the way on the right.

On the way on the left, those square points represent the active zone minutes you achieved each day that you wore the Fitbit before we started meeting. The white circles after that represent the active zone minutes you achieved each day during the time we were meeting weekly, up until last week. Overall, your number of active zone minutes logged per day hasn’t changed much.

The new information that we’re looking at this week are the points in the red bracket. Those points represent each day between our last meeting and our meeting today. These new points are separated from the earlier ones by a bar, because this week you started texting me your active zone minute totals only each day, as opposed to all your physical activity metrics, and I gave you a specific active zone minute goal to reach instead of you setting your own goal.

The goal set for you during our meeting last week was 32 active zone minutes per day on 5 of 7 days, and that’s the green horizontal bar on the graph across this last week. You achieved at least 32 active zone minutes on 3 of 7 days last week, which did increase from only two days in the week before, but it is still two days short of your goal.

Could you please describe that back to me, including what the graph is showing and how you did this week?
**Participant:** This was the first week that you set a goal for me, and even though I had more active zone minutes than last week on a couple of days, I didn’t reach the goal you set. That all makes sense. What day of the week was that day with the fewest active zone minutes?

C: That was last Friday.

P: That makes sense, it was a busy work day at my computer on Friday, and then we had movie night.

C: Yes, that makes sense. Any other questions?

P: No, that’s it.

C: Great. Remember, the more physical activity you get, the more benefits to your health. Even some activity is better than none. The World Health Organization recommends that adults your age get 150-300 minutes of moderate-intensity activity (i.e., active zone minutes) in total spread across the week. One in four Americans doesn’t reach the recommended amount of physical activity, but if you are achieving the goal I have set for your right now, to get at least 32 zone minutes on 5 out of 7 days, you’ll move from below that recommended range to right inside of it! We’re going to take slow steps to increase your activity each week and try to build up to a place where you can maximize those benefits as well, like promoting healthy blood pressure, reducing the risk of diabetes and stroke, and promoting a healthy heart.

C: So, your goal for next week will be the same, to achieve 32 active zone minutes per day on at least 5 of 7 days. We’re going to meet at this same time next week and review your progress.
**APPENDIX N: SOCIAL VALIDITY SURVEY**

<table>
<thead>
<tr>
<th>Phase (circle one):</th>
<th>Coach-led</th>
<th>Participant-led</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>This experience was worth the time spent.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>It was difficult to participate in this study.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I enjoyed talking to the coach.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The coaching sessions helped me achieve my goals.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The coaching sessions helped me increase my physical activity.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I enjoyed the role I had during the coaching sessions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I disliked the level of involvement I had during coaching sessions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The use of a smartphone/computer made the process more difficult.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The goals were helpful in increasing my physical activity.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Being able to access my Fitbit account was helpful in increasing my physical activity.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Submitting my active minutes to the coach was helpful in increasing my physical activity.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I enjoyed the way that feedback was given during these sessions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The feedback provided during these sessions was helpful.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would recommend this type of coaching to a friend.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Was there any portion of the experience you would like to change? If so, what change(s) do you recommend?

Additional Comments:

*Circle one:*
During sessions, I preferred:
- When the coach took the lead
- When I took the lead
- I liked both versions equally

Why:
# APPENDIX O: HEALTH COACHING RATING FORM

<table>
<thead>
<tr>
<th>Questionnaire Items</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>I found the health coaching session to be nondirective</td>
<td>1  2  3  4  5  6  7</td>
</tr>
<tr>
<td>I found the health coaching session to be client-centered</td>
<td>1  2  3  4  5  6  7</td>
</tr>
<tr>
<td>I believe the health coach asked an appropriate number of open-ended questions</td>
<td>1  2  3  4  5  6  7</td>
</tr>
<tr>
<td>I believe the health coach used reflective listening appropriately during the session</td>
<td>1  2  3  4  5  6  7</td>
</tr>
<tr>
<td>I believe the health coach used summary statements appropriately during the session</td>
<td>1  2  3  4  5  6  7</td>
</tr>
<tr>
<td>I believe the health coach appropriately supported participant goal setting</td>
<td>1  2  3  4  5  6  7</td>
</tr>
<tr>
<td>I believe the health coach delivered feedback appropriately during the session</td>
<td>1  2  3  4  5  6  7</td>
</tr>
<tr>
<td>I believe the health coach offered health information when appropriate</td>
<td>1  2  3  4  5  6  7</td>
</tr>
<tr>
<td>Overall, I had a positive reaction to the health coaching session</td>
<td>1  2  3  4  5  6  7</td>
</tr>
<tr>
<td>Like and dislike</td>
<td>1 (Strongly Dislike), 4 (Neutral), 7 (Strongly Like)</td>
</tr>
<tr>
<td>The style and format of discussion</td>
<td>1  2  3  4  5  6  7</td>
</tr>
<tr>
<td>Goal setting</td>
<td>1  2  3  4  5  6  7</td>
</tr>
<tr>
<td>Feedback statements used</td>
<td>1  2  3  4  5  6  7</td>
</tr>
</tbody>
</table>

Comments:
Physical Inactivity

Physical inactivity is a major public health problem worldwide. Insufficient physical activity is a leading risk factor for noncommunicable diseases such as heart disease, cancer, and diabetes, and it is now the fourth leading risk factor for mortality (World Health Organization, 2014a; World Health Organization, 2018). Chronic health conditions associated with physical inactivity, such as obesity, place individuals at higher risk for further health-related problems including hypertension, high cholesterol, and stroke (Centers for Disease Control and Prevention, 2019a; Centers for Disease Control and Prevention, 2019b; Centers for Disease Control and Prevention, 2020b; U.S. Department of Health and Human Services National Institutes of Health, 2013).

On the other hand, engaging in sufficient physical activity provides many health benefits. Physical activity promotes healthy weight loss, helps to reduce blood pressure, and helps to reduce the risk of diabetes, heart attack, and stroke (Centers for Disease Control and Prevention, 2015). Although it is true that some health benefits can be gained simply by transitioning from no physical activity to some, dose-response relations exist between the dimensions of physical activity and the benefits obtained (World Health Organization, 2010). Namely, increases in the intensity, frequency, and duration of activity are directly related to risk reductions for cardiovascular disease and coronary heart disease (World Health Organization, 2010). To that end, specific guidelines for the recommended amounts of physical activity are made widely available.
The World Health Organization recommends that adults between 18 and 64 engage in at least 150 min of moderate-intensity activity throughout the week (30 min of moderate-intensity activity per day), or 75 min of vigorous physical activity throughout the week, in order to stave off the negative effects of inactivity and reap the health benefits of an active lifestyle (World Health Organization, 2010; World Health Organization, 2018). Although some objective measures exist for indicating the intensities described by moderate and vigorous activities (e.g., oxygen consumption, Metabolic Equivalents [MET], target heart rate related to maximum heart rate, and the Borg Rating of Perceived Exertion [RPE]), moderate and vigorous-intensity activities are more commonly described subjectively. For example, the World Health Organization (WHO) deems an activity moderate-intensity when it requires moderate effort, meaning that it noticeably accelerates an individual’s heart rate, and something is deemed vigorous-intensity when the activity requires a large amount of effort, meaning that it causes rapid breathing and substantially increases an individual’s heart rate (World Health Organization, 2014b). Similarly, the Center for Disease Control (CDC) describes moderate-intensity activities as those during which an individual can talk but not sing, and vigorous-intensity activities as those during which an individual will not be able to say more than a few words at a time (Centers for Disease Control and Prevention, 2020a).

A common, quantified version of the guidelines for physical activity is expressed in terms of recommended daily step counts, as measured by pedometers. Commercially available pedometers are low-cost, user-friendly, and produce easily interpretable data. Additionally, smart phones and fitness trackers often include both pedometers and accelerometers; therefore, such devices can offer more information than step count alone (e.g., intensity of activity). With the increased availability of smart phones and wearable fitness trackers, pedometers have
become commonplace, so step count is a widely accessible measure of physical activity (Tudor-Locke, 2002b). That being said, there is no perfect translation from the recommended levels of MVPA to daily step counts, and step-based recommendations vary greatly across organizations. With respect to intensity, Tudor-Locke et al. (2011) reviewed 5 studies that directly measured step-count and verified moderate activity in terms of METS or oxygen consumption; all 5 studies concluded that 100 steps per min is a reasonable rate to achieve moderate intensity walking. In terms of frequency, 5,000 steps per day or fewer has been suggested as indicative of a sedentary lifestyle (Tudor-Locke et al., 2002a; Tudor-Locke et al., 2008; Tudor-Locke & Bassett, 2004), and 8,000 steps per day has been suggested as a minimal recommended frequency for a healthy lifestyle (taking into account an additional 100 steps per min for 30 min beyond the sedentary amount; Tudor-Locke et al., 2011). Despite standard recommendations for healthy levels of physical activity, one in four adults worldwide does not meet physical activity guidelines (World Health Organization, 2010; World Health Organization, 2018), indicating that something needs to change.

**Behavioral Interventions**

Physical inactivity is a problem that requires changing behavior, and it should be addressed using interventions that have been demonstrated effective in well-controlled experiments or developed as conceptually systematic interventions rooted in well-established principles of behavior change. In other words, the problem of physical inactivity should be addressed using applied behavior analysis. Although there is no single set of features that define the practice of applied behavior analysis, many professionals in the field agree that applied behavior analytic interventions are ones that include operational definitions of one or more target behaviors, involve direct observation and repeated measures of the behavior(s) of interest across
time, and are evaluated using single-case experimental designs (Baer et al., 1968; Baer et al., 1987; cf. Critchfield & Reed, 2017).

Applied behavior analysis has been addressing the problem of physical inactivity since the 1970s. Early interventions in applied behavior analysis targeted increases in physical activity using a variety of measures including aerobic point values (e.g., Wysocki et al., 1979) and rate of pedaling on stationary bicycles (e.g., DeLuca & Holborn, 1990; DeLuca & Holborn, 1992). More recent measures of physical activity targeted in the applied behavior analytic literature include direct observation of physical activity in children (Boga & Normand, 2017; Hustyi et al., 2011; Hustyi et al., 2012; Larson et al., 2011; Larson et al., 2013; Larson et al., 2014; McIver et al., 2009; Zerger et al., 2016), direct measures such as heart rate (e.g., Donaldson & Normand, 2009; Larson et al., 2011; McKenzie et al., 1991), and supplemental indirect measures such as weight loss (Donaldson & Normand, 2009; Normand, 2008; VanWormer, 2004). Furthermore, recent studies have targeted physical activity primarily in the form of step counts with children and adults (e.g., Andrade et al., 2014; Ek et al., 2016; Galbraith & Normand, 2017; Hayes & Van Camp, 2015; Hustyi et al., 2011; Kuhl et al., 2015; Kurti & Dallery, 2013; Li et al., 2018; Miller et al., 2018; Normand, 2008; Valbuena et al., 2015; Van Camp & Berth, 2018; VanWormer, 2004; Washington et al., 2014; Zerger et al., 2017). Step count is both a clinically relevant measure of physical activity due to its association with the previously discussed health conditions, and it can be easily and reliably measured (Tudor-Locke, 2002b).

Interventions for increasing physical activity in applied behavior analysis have been effective with both children (e.g., Fogel et al., 2010; Hustyi et al., 2011; Larson et al., 2011; Shayne et al., 2012) and adults (e.g., Donaldson & Normand, 2009; Kurti & Dallery, 2013; Normand, 2008; Petry et al., 2011; VanWormer, 2004) and have included combinations of self-
monitoring, goal-setting, and feedback (Donaldson & Normand, 2009; Normand, 2008; VanWormer, 2004), as well as Contingency Management (Irons et al., 2013; Kurti & Dallery, 2013; Petry et al., 2011). Self-monitoring is most often used in combination with other treatment package components (e.g., goal setting and feedback), and such self-monitoring treatment packages are highly efficacious for increasing physical activity (Page et al., 2020). However, VanWormer (2004) suggests that even self-monitoring alone could be effective.

VanWormer (2004) measured physical activity during baseline phases in which participants wore masked pedometers, followed by a self-monitoring phase during which the pedometer was unmasked and participants input their daily step total into a spreadsheet at the end of each day, and finally an e-counseling phase in which pedometers remained unmasked and participants engaged in weekly email conversations with the experimenter. All three participants’ daily step counts increased between baseline and self-monitoring phases, but only one of three participants’ daily step counts increased further when e-counseling was introduced. Self-monitoring is often used in package interventions with goal setting and feedback (Donaldson & Normand, 2009; Normand, 2008; VanWormer, 2004), but the results of VanWormer (2004) suggest that self-monitoring alone might be a sufficient intervention for increasing physical activity. Component analyses are needed to further examine the effectiveness of self-monitoring alone on physical activity (Page et al., 2020; Van Camp & Hayes, 2012).

Although interventions in applied behavior analysis have produced increases in the physical activity of adults and children through a variety of methods, these interventions are not widely used. One possible factor in the lack of deployment of these interventions is a potential “marketing problem” (Bailey, 1991) faced by the field. The concern underlying the marketing
problem, shared by some professionals within applied behavior analysis, is that off-putting language hinders the efforts of behavior analysts to help others (e.g., Bailey, 1991; Doughty et al., 2012; Foxx, 1996; Freedman, 2015; Witt et al., 1984). In that vein, Foxx (1996) suggests that “our words affect our image and hence our ability to relate to others” (Foxx, 1996, p. 147), and clients are more likely to adhere to suggestions provided by those they feel comfortable with (Backer et al., 1986; Barrett-Lennard, 1962; Rosenzweig, 1936). The field of applied behavior analysis has been criticized as a field with a “rigid preoccupation with order and control” that adheres to “routine for the sake of routine” (Silberman, 1970, as cited by Winett & Winkler, 1972), for example, by way of forcing quiet and calmness upon students in educational institutions (Winett & Winkler, 1972; cf. O’Leary, 1972).

Comparisons have been made between applied behavior analysis and client-centered counseling, a nondirective approach which “trends away from guiding and directing the client,” and places “stress upon catharsis and insight” (Rogers, 1946b, p. 415), in terms of the language used by the professionals who represent them (Critchfield et al., 2017). For example, Critchfield, Becirevic, and Reed (2017) extracted selected statements from B.F. Skinner and Carl Rogers from a joint publication (Rogers & Skinner, 1956) and assigned each of the key words a valence rating from Dodd’s corpus, a collection of words rated by participants on a 9-point scale from “happy” to “unhappy.” Results of their subsequent comparison showed that the vocabulary used by Skinner when discussing applied behavior analysis was more negative, overall, than that used by Rogers when discussing client-centered therapy (Critchfield et al., 2017).

Psychologists, speaking more broadly than just the field of applied behavior analysis, have emphasized the importance of the client-therapist relationship (e.g., Kirschenbaum & Jourdan, 2005; Rogers, 1951). This is evidenced by graduate training programs in clinical
psychology in which students are supposed to receive extensive training on how to interact with clients through techniques considered compassionate and empathetic (Heitzman-Powell et al., 2007; Nietzel et al., 1991). On the other hand, behavior analysts are trained to speak scientifically (e.g., Bailey, 1991; Doughty et al., 2012; Foxx, 1996; Freedman, 2015; Heitzman-Powell et al., 2007; Witt et al., 1984). Some have suggested that, as a result, those in the broader field of clinical psychology view behavior analysts as subpar in terms of therapeutic relationship skills (Kowalski, 1984).

Research in clinical psychology suggests that therapist characteristics and therapist-client interactions have an impact on the effectiveness of interventions (American Psychological Association, 2006; Broekman et al., 1985; Critis-Christoph et al., 1991). Furthermore, there is evidence to suggest that a counseling approach that emphasizes the therapeutic relationship may be preferred by clients to one that is instead more effective (Swift & Callahan, 2010). In other words, a therapist with higher levels of certain interpersonal skills might be preferred to one without those skills but who affects more change (Swift & Callahan, 2010). Swift and Callahan (2010) used delay discounting methods to determine whether clients would choose descriptions of treatments delivered by therapists with preferred characteristics (i.e., an emphasis on the therapeutic relationship, interpersonal responses from the therapist, a higher therapist experience level, and a higher degree of client-directedness) more than ones described to be more effective. Swift and Callahan (2010) found that clients chose the description of a less-effective intervention over a more-effective one in favor of an empathetic therapist, a developed therapeutic relationship, client-directed sessions, and a therapist with more years of education and clinical experience. Based on the results of their study, Swift and Callahan (2010) recommend that therapists collaborate with clients to make decisions about their treatment. That being said, the
studies on client preferences relied on the self-report of the participants, therefore we are unable to generalize the findings to actual choice between treatment types in a therapeutic environment.

The call for professionals within psychology to practice in a way that is sensitive to their clients extends into the field of applied behavior analysis. For example, Slocum et al. (2014) described Applied behavior analysis as an evidence-based practice, defined by as a decision-making process informed by integration of the best available evidence, clinical expertise, and client values and context. This definition of evidence-based practice within applied behavior analysis emphasizes that decision-making is informed by client values, specifically when determining treatment goals and processes. Furthermore, the “applied” component of applied behavior analysis is widely accepted to refer to the production of a socially significant change in behavior, one that holds practical value to society (Baer et al., 1968), or in other words, is acceptable to the population served. Wolf (1978) suggested that the success of applied behavior analysis is based on the social validity of the practice, meaning that the acceptability of its practices to the client and the consideration of goals and processes that are meaningful to the clients are the key to measuring the success of the practice. Wolf (1978) further proposed that the acceptability of behavior-change programs may be related to their effectiveness.

There is limited evidence in behavior analysis, similar to general psychology, to suggest that a treatment approach that favors the therapeutic relationship may be preferred by clients to one that is more effective. Chadwell et al. (2019) replicated the methodology of Swift and Callahan (2010) to investigate the preference of parents for the “nonspecific” aspects of applied behavior analytic treatment for their children, that is, those aspects that are related to treatment process as opposed to content. Chadwell et al. (2019), similar to Swift and Callahan (2010), found that participants preferred descriptions of less-effective treatments delivered by therapists
with preferred characteristics (e.g., they were warm, accepting, experienced, and did more listening) over more-effective treatments delivered by therapists with fewer preferred characteristics. Because of this, Chadwell et al. (2019) recommended that professionals collaborate with their clients to make decisions about their treatment.

Such collaboration is actually codified in the Professional and Ethical Compliance Code for Behavior Analysts (2020) to “make appropriate efforts to involve clients and relevant stakeholders throughout the service relationship, including selecting goals, selecting and designing assessments and behavior-change interventions, and conducting continual progress monitoring” (Behavior Analyst Certification Board, 2020, Section 2.09). “Behavior analysts select, design, and implement behavior-change interventions that…best meet the diverse needs, context, and resources of the client and stakeholders. Behavior analysts also consider relevant factors (e.g., client and stakeholder preference) …” (Behavior Analyst Certification Board, 2020, Section 2.14), and “obtain informed consent from clients, stakeholders, and research participants (e.g., before initial implementation of assessments or behavior-change interventions, when making substantial changes to interventions, when exchanging or releasing confidential information or records).” (Behavior Analyst Certification Board, 2020, Section 2.11). Under this code, behavior analysts “respect and actively promote clients’ self-determination to the best of their abilities” (Behavior Analyst Certification Board, 2020, p. 4), and “acknowledge that personal choice in service delivery is important by providing clients and stakeholders with needed information to make informed choices about services (Behavior Analyst Certification Board, 2020, p. 4).
**Client-Centered Treatment**

Client-centered therapy, also termed nondirective or person-centered therapy, is an approach to treatment delivery that focuses on the therapeutic relationship. The client-centered approach was formally developed by Carl Rogers in the 1940s, resulting in his seminal work on the topic in 1951 (Rogers, 1951). A client-centered approach places emphasis on what the participant wants, without the therapist exerting authority over the client in the therapeutic relationship (Sollod, 1978). In other words, the therapist’s role is to help the client without wielding any power or control over them (Sollod, 1978). Client-centered treatments were developed within clinical psychology as a nondirective therapy approach in which therapists most heavily use reflection, clarification, and accepting statements, as opposed to the directive questions and interpretations commonly used by traditional psychoanalysts at the time of its inception (Rogers, 1946a).

Much of the research on client-centered treatment within clinical psychology has focused on the process and delivery of treatment (e.g., Klein et al., 1986; Klein et al., 1970; Porter, 1943; Snyder, 1945). Early research on client-centered therapy focused on three core conditions of the approach: unconditional positive regard, empathy, and congruence (Kirschenbaum & Jourdan, 2005; Rogers, 1957). Unconditional positive regard was described as “a warm acceptance of each aspect of the client’s experience as being a part of that client…it means that there are no conditions of acceptance” (Rogers, 1957, p. 98). Empathy was described by Rogers as, “sensing the client’s private world as if it were your own,” and he describes that “when the client’s world is clear to the therapist…then he can both communicate his understanding of what is clearly known to the client and can also voice meanings in the client’s experience of which the client is scarcely aware” (Rogers, 1957, p. 99). Finally, congruence refers to genuineness from the
therapist, or “the opposite of presenting a façade” (Rogers, 1957, p. 97). Rogers claimed that these three conditions, present together, were sufficient to cause therapeutic change (Rogers, 1957). Rogers posited that a client’s perception of these three conditions alone would produce desired therapeutic change, regardless of the specific therapeutic techniques used (Rogers, 1957).

Outcome studies have examined the effects of client-centered treatment using rating scales (e.g., Barrett-Lennard, 1962; Halkides, 1958; Porter, 1943) to evaluate therapists’ use of the key elements of client-centered treatment (Kirschenbaum & Jourdan, 2005). These studies found positive correlations between the use of the core components and positive treatment outcomes, and although they did not support Roger’s claim that all three conditions together were necessary nor sufficient to produce desired change, they did lend support the claim that a client’s perception of the core conditions is very helpful to achieving desired outcomes for almost all clients (Kirschenbaum & Jourdan, 2005). The current discourse in the field of psychology has moved away from a specific set of therapeutic relationship conditions and toward an individualized approach to building a therapeutic relationship, while continuing to emphasize the importance of the therapeutic relationship to achieving successful outcomes (Norcross, 2001).

Outside of psychotherapy, some studies have attempted to compare client-centered approaches to behavior-change to more directive behavior-change interventions (e.g., Alper & Kranzler, 1970; Andrews, 1971; Duncombe et al., 2016; Holen & Kinsey, 1975), and to applied behavior analysis interventions (Bernal et al., 1980; Marlowe et al, 1978). These comparisons are limited in number and have produced mixed results (e.g. Bernal et al., 1980; Marlowe et al, 1978). For example, Marlowe et al. (1978) compared behavioral counseling to client-centered counseling to decrease the inappropriate classroom behavior of elementary-school students.
Their behavioral counseling involved attention for appropriate behavior and ignoring inappropriate behavior, and the client-centered counseling involved acceptance of the student and a friendly relationship, and instructions on taking responsibility for your decisions (Marlowe et al., 1978). The client-centered counsellors were instructed to reflect students’ feelings, allow counseling to proceed at the pace the students chose, and to avoid presenting “a façade,” among other things; however, these aspects of the approach were not further described or defined in operational terms (Marlowe et al., 1978). Results indicated that the behavioral counseling was effective in reducing challenging classroom behavior, whereas the client-centered counseling did not produce behavior change (Marlowe et al., 1978).

Bernal et al. (1980) compared parent training in behavior management skills to client-centered parent counseling for decreasing the challenging behaviors of children. Their behavioral parent training included identifying potential reinforcers and arranging reinforcement contingencies, and their client-centered counseling involved the exploration of ideas of discipline, meaning behind their child’s behavior, and their role as a parent (Bernal et al., 1980). Bernal et al. (1980) found no difference in child behavior, as observed by experimenters, between those whose parents received behavioral parent training compared to those whose parents had received client-centered counseling. It is notable, however, that parents who had received behavioral parent training self-reported significantly greater improvement in their children’s behavior, on average, than the parents who had received client-centered counseling. Interestingly, this suggests that the behavioral approach may have had greater social validity than the client-centered approach, separate from effectiveness.
Health Coaching

The client-centered approach established by Rogers remains alive and well (Kirschenbaum & Jourdan, 2005). Since the origin of client-centered therapy in clinical psychology in the 1940s, it has been adopted as a professional approach by other fields including law (Binder et al., 1990), vocational services (Salomone, 1971; Whiteley & Resnikoff, 1978), social work (Washburn & Grossman, 2017), medicine (Chewning & Sleath, 1996; Fazio et al., 2018), and health. With regard to health, health coaching has emerged as a client-centered approach to health-related behavior-change (Olsen, 2013). Health coaching has been defined in a variety of ways in the literature (Olsen, 2013; Wolever et al., 2013), but, in attempts to produce clear, consistent definitions of health coaching, Olsen (2013) and Wolever et al. (2013) each offered reviews of the health coaching literature from which common themes emerged. Olsen (2013), for example, provided the following definition based on the available descriptions of health coaching in the literature: “Health coaching is a goal-oriented, client-centered partnership that is health-focused and occurs through a process of client enlightenment and empowerment” (Olsen, 2013, p. 24). This definition was based on common themes among the health coaching studies she reviewed: health coaching was health-focused, involved a partnership between client and coach, was client-centered, was goal-oriented, involved a process over time, was enlightening, and was empowering. Similarly, Wolever et al. (2013) reviewed the health and wellness coaching literature with the aim of producing one standard, consistent definition of the practice. Based upon their review, the authors suggested that health coaching is:

A patient-centered approach wherein patients at least partially determine their goals, use self-discovery of active learning processes together with content education to work toward their goals, and self-monitor behaviors to increase accountability, all within the
context of an interpersonal relationship with a coach. The coach is a healthcare professional trained in behavior change theory, motivational strategies, and communication techniques, which are used to assist patients to develop intrinsic motivation and obtain skills to create sustainable change for improved health and well-being. (Wolever et al., 2013)

One common theme among these definitions is that the health coach assists the client in determining their own behavior-change goals (Olsen, 2013; Wolever et al, 2013). More specifically, health coaches are taught to help clients define their goals in specific and measurable terms so that progress toward the goal can be evaluated. Health coaches often employ SMART goals, or ones that are Specific, Measurable, Attainable, Relevant, and Time-bound (American Council on Exercise, 2017). Health coaches help clients create SMART goals by asking questions that evoke specific details, and by reflecting back to the client the connection between their goals and their values (American Council on Exercise, 2017; Wolever et al., 2013).

As evidenced by its inclusion in the definitions of Olsen (2013) and Wolever et al. (2013), health coaching has commonly been described as client-centered in the research literature (e.g., Bennet et al., 2005; Butterworth, 2008; Huffman, 2007). The client-centered aspect of health coaching includes a focus on the client during coaching sessions and treatment customization for the individual client (Olsen, 2013). Olsen (2013) summarized the meaning of client-centered as it applies to health coaching in this way, “The client-centered attribute can be observed as individualization in health coaching, as well as through client determination of topics and decisions” (Olsen, 2013, p. 25). Similarly, Wolever et al. (2013) reviewed the health and wellness coaching literature and sought, in part, to determine whether the coaching provided in the literature was patient-centered as it has been defined by the Institute of Medicine (2001):
“Providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions” (Institute of Medicine, 2001, p. 2). Of the 284 total articles reviewed by Wolever et al. (2013), 86% of articles described the process as patient-centered. Furthermore, Wolever et al. (2013) describes the emphasis on the client-coach relationship common among conceptualizations of health coaching:

There is evidence that behavior change and learning occur most reliably when there is a helping relationship that (1) acknowledges the individual, (2) is collaborative, and (3) encourages active learning. (See Dill and Gumpert [2012] for review.) Reaching back to the theoretical roots of Adler, Jung, and Rogers, health and wellness coaching conceptualizes patients as lifelong learners whose individual personal values and innate internal resources can be cultivated in the context of a supportive relationship to guide them toward their own desired vision of health. (Wolever et al., 2013)

The client-centered practice of health coaching is growing, as is the number of peer-reviewed articles in the field (Wolever et al., 2013). Health coaching has been evaluated primarily with adults, and it has been studied in a preventive capacity toward nutrition, exercise, and weight loss goals, as well as in a reactive capacity to address chronic health conditions such as pain, COPD, diabetes, and CVD (Olsen, 2013). Reviews of the effectiveness of health coaching have shown promise (Dejonghe et al., 2017; Kivela et al., 2014; Lindner et al., 2003; Olsen & Nesbitt, 2010), but the research methods used have limitations that make drawing conclusions about efficacy and effectiveness challenging; most studies aimed at evaluating health coaching interventions used nonrandomized group designs, experienced substantial attrition, and did not directly measure the behavior(s) of interest (Kivela et al., 2014; Lindner et al., 2003; Olsen & Nesbitt, 2010; Simmons & Wolever, 2011; Wolever et al., 2013).
The methods used in applied behavior analysis could be applied to the field of health coaching to address the limitations of the health coaching literature (Normand & Bober, 2020). Operationally defining one or more target behaviors, directly observing and measuring the behavior(s) of interest over time, and evaluating the effects of health coaching interventions using single-case research designs would address the previously-mentioned limitations of the existing health coaching research base. Reports from clients or caregivers are subject to influence by variables not affecting the behavior of interest, and therefore can provide an inaccurate picture (Kazdin, 2011). Defining an observable behavior in terms of how it will be measured, and measuring it directly, allows for a more accurate measure of the behavior of interest (Kazdin, 2011). Additionally, the use of single-case designs to evaluate the effectiveness of client-centered health coaching interventions would allow health coaching practitioners to evaluate the effects of their practice on their individual client and make ongoing treatment decisions (Morgan & Morgan, 2001).

**Purpose**

In the applied behavior analysis literature, package interventions comprised of goal setting, self-monitoring, and feedback components have been shown to increase physical activity (Donaldson & Normand, 2009; Donlin Washington et al., 2014; Kurti & Dallery, 2013; Normand, 2008; Smith & Ward, 2006; VanWormer, 2004; Wack et al., 2014; Zarate et al., 2019). Furthermore, behavior analysts are encouraged to deliver their interventions in a way that involves client preferences and prioritizes social validity (Baer et al., 1968; Behavior Analyst Certification Board, 2014; Wolf, 1978). Client values and goals are intertwined in the definition of applied behavior analysis put forth by Baer et al (1968;1987). The behavior change produced by applied behavior analysis should be socially important in order to be considered effective.
(Baer et al., 1968), and to be an applied science is to address problems that trouble our clients (Baer et al. 1987). Similarly, Wolf (1978) suggested that the success of applied behavior analysis is based on the acceptability of its goals, procedures, and effects to society, and stressed the importance of bringing the consumer into our science in that way. Behavior analysts are even obligated by their professional ethics code to “make appropriate efforts to involve clients and relevant stakeholders throughout the service relationship, including selecting goals, selecting and designing assessments and behavior-change interventions, and conducting continual progress monitoring” (Behavior Analyst Certification Board, 2020, Section 2.09). Under this code, behavior analysts “respect and actively promote clients’ self-determination to the best of their abilities” (Behavior Analyst Certification Board, 2020, p. 4), and “acknowledge that personal choice in service delivery is important by providing clients and stakeholders with needed information to make informed choices about services (Behavior Analyst Certification Board, 2020, p. 4). In other words, you could say that behavior analysts are urged to practice in a way that is “client-centered.”

Health coaching has emerged as an alternative, client-centered approach to increasing physical activity, and the practice continues to grow (Olsen, 2013), but the extent of its effectiveness is unclear from the existing research due to some key limitations of that literature. Most notably, the existing research relies on group research designs resulting in a lack of individual-level data, and there is a reliance on indirect measures of the behavior(s) of interest evaluated with inferential statistics, as opposed to the determination of clinical significance that is directly measured (e.g., Kivela et al., 2014; Lindner et al., 2003; Olsen & Nesbitt, 2010; Simmons & Wolever, 2011; Wolever et al., 2013). Health coaching, despite not being consistently defined (Olsen, 2013; Wolever et al., 2013), includes common features such as a
focus on client-set goals brought about through motivational interviewing techniques, during repeated contacts with a coach who shares health-related information and empowers a client to participate in health-related behavior change (Olsen, 2013; Olsen & Nesbitt, 2010). We do not know much about the effectiveness of health coaching interventions, or about the relative effects of established, directive interventions in applied behavior analysis for increasing physical activity. As such, the purpose of the present study is to evaluate the effects of a largely nondirective, client-centered health coaching approach for increasing physical activity of adults, and the relative effects of a directive coaching approach.