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Evaluating the Effects of Self-Monitoring on Physical Activity Within a Health Coaching Package

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Abstract

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The World Health Organization recommends that adults engage in at least 150 minutes of moderate to vigorous physical activity every week. Engaging in physical activity improves long-term health, unfortunately, half of the adults in the United States do not meet the recommended levels. Health coaching is a patient-oriented approach to deliver behavior change interventions that has been shown to increase physical activity and improve health outcomes. Self-monitoring is a component of health coaching, and is a behavior change technique that has been identified as an integral component of health interventions that resulted in improved health outcomes. However, the specific effects of self-monitoring as a component of a health coaching package are unclear. The current study employed a single-case, multiple-baseline across participants design to evaluate the effects of self-monitoring on physical activity within a health coaching package. Three adult females participated in the study. Active Zone Minutes and steps were the primary and secondary dependent variables, as measured by the Fitbit Inspire 2. There were no clear changes in physical activity, as measured by Active Zone Minutes and step counts, across the health coaching and instructed self-monitoring phases for any of the three participants.

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CHAPTER 1: INTRODUCTION

Effects of Health Coaching Packages and Self-Monitoring Interventions on Physical Activity and Health Outcomes

The World Health Organization (2020) defines physical activity as "bodily movement produced by skeletal muscles that requires energy expenditure" and recommends that adults engage in at least 150-300 min of moderate, or 75-150 min of vigorous, physical activity every week (World Health Organization [WHO], 2020). Meeting the recommended level of physical activity lowers the risk of high blood pressure and stroke; prevents weight gain, diabetes, heart disease, and cancer; and improves aerobic and muscular fitness, mental health, cognitive function, and sleep (Center for Disease Control and Prevention [CDC], 2020; WHO, 2020). Unfortunately, half of the adults in the United States do not engage in the amount of physical activity required to help prevent chronic diseases (CDC, 2020). However, patient-centered approaches to managing health may increase physical activity and other behaviors that impact chronic health conditions (Finn & Watson, 2017; Hill et al., 2015; Kivelä et al., 2014; Olsen & Nesbitt, 2010).

Health Coaching

Health coaching is a patient-oriented approach to delivering behavior-change interventions that has been shown to improve health outcomes such as weight (Johnson et al., 2019; Michaelides et al., 2016; Tucker et al., 2008; Vale et al., 2003), blood pressure (Turner et al., 2012; Vale et al., 2003; Willard-Grace et al, 2015), and cholesterol (Vale et al., 2003; Young et al., 2015) across settings and populations (Butterworth et al., 2007; Kivelä et al., 2014). In a review of 13 health coaching studies published between 2009 and 2013, Kivelä et al. (2014) reported increased physical activity, better weight management, and improved physical health

for patients diagnosed with a chronic disease who received a health coaching intervention. Six of the 10 studies that evaluated behavioral outcomes reported increased physical activity, and of the studies that evaluated physiological outcomes, three that measured weight reported significant improvements. Two of three studies reported significant improvements in body mass index (BMI), two of four reported significant improvements in HbA1C, and three of four reported significant improvements in patient-reported "perceived" physical health status (Kivelä et al., 2014). Olsen and Nesbitt (2010) also reported significant positive effects of health coaching on weight management, physical activity, and nutrition in 40% of the articles reviewed.

To achieve these results, health coaches typically meet with clients weekly and use motivational strategies to help clients identify their goals, provide education and feedback to support clients in working toward those goals, prompt clients to engage in behavior change techniques with the purpose of motivating clients to achieve their goals, support them through behavior change, and ultimately improve their health (Butterworth et al., 2007; Olsen & Nesbitt, 2010; Wolever et al., 2013). In behavior-analytic terms, health coaches motivate and support clients by identifying and defining target behaviors; by providing stimulus discrimination training with task clarification and feedback; and by manipulating environmental variables to evoke and reinforce target behaviors (Normand & Bober, 2020). For example, health coaches identify and define target behaviors through motivational interviewing techniques (Bennett et al., 2010; Butterworth et al., 2007; Wolever et al., 2013); they provide stimulus discrimination training and task clarification with goal-setting and action planning (Bennett et al., 2010; Brodin et al., 2008; Vale et al., 2003); and they manipulate environmental variables to evoke and reinforce target behaviors by providing education, delivering performance feedback, and prompting self-monitoring (Bennett et al., 2010; Brodin et al., 2008; Paineau et al., 2008).

Self-Monitoring

Self-monitoring is one behavior change technique that has been identified as an integral component of health interventions that has resulted in improved health outcomes related to hypertension, chronic obstructive pulmonary disease, heart failure, weight, healthy eating, and physical activity (Burke et al., 2011; McBain et al., 2015; Michie et al., 2009; Patel et al., 2021). Self-monitoring has been described as the observation of one's own behaviors (Nelson & Hayes, 1981), often while keeping a record of those behaviors and behavioral outcomes (Michie et al., 2011), and it is a self-management strategy that often results in "self-directed" behavior change (Cooper et al., 2020). Across studies evaluating the effects of self-monitoring on health-related behavior, self-monitoring alone has been shown to decrease smoking (e.g., McFall, 1970) and to increase physical activity (e.g., Burke et al., 2011; Critchfield, 1999; VanWormer, 2004).

Studies that evaluated the effects of self-monitoring on health outcomes reported decreased weight (Burke et al., 2011; Patel et al., 2021). Interventions that combined self-monitoring with other behavior-change techniques have also shown positive outcomes with health-related behavior (Normand, 2008; VanWormer, 2004) and health outcomes (Burke et al., 2011; Donaldson & Normand, 2009; Patel et al., 2021). For example, VanWormer (2004) had participants wear a pedometer and record steps onto a spreadsheet daily, and all three participants increased daily steps from baseline levels when asked to self-monitor. Following a phase of self-monitoring, VanWormer (2004) introduced e-counseling via email that consisted of review, goal setting, and praise; one participant showed increased daily steps with this addition. Similarly, Normand (2008) reported increased daily step totals for all participants following the introduction of self-monitoring, goal setting, and feedback.

Within the health coaching literature, self-monitoring methods vary, but there are several common components. Typically, individuals attend to and keep a record of their behavior with written logs (Saelens et al., 2002; Tucker et al., 2008) or smart phone applications (Coughlin et al., 2020; Johnson et al., 2019; Khan et al., 2020; Michaelides et al., 2016). Food and beverage intake (Coughlin et al., 2020; Johnson et al., 2019; Khan et al., 2020; Michaelides et al., 2016; Paineau et al., 2008; Saelens et al., 2002; Wolever et al., 2010) and physical activity (Brodin et al., 2008; Coughlin et al., 2020; Johnson et al., 2019; Khan et al., 2020; Michaelides et al., 2016; Saelens et al., 2002; Wolever et al., 2010) are common self-monitored behaviors, and weight is a common self-monitored behavioral outcome (Coughlin et al., 2020; Johnson et al., 2019; Michaelides et al., 2016; Saelens et al., 2002). Participants can record behavior and behavioral outcomes daily (Edelman et al., 2006; Johnson et al., 2019; Saelens et al., 2002) or weekly (Bennett et al., 2010; Coughlin et al., 2020; Johnson et al., 2019; Michaelides et al., 2016; Saelens et al., 2002). For example, Saelens et al. (2002) required participants to monitor behavior daily with a written log of food intake and physical activity and monitor behavioral outcomes weekly by written log of weight. Alternatively, Johnson et al. (2019) had participants wear a fitness device and use a smart phone application to record daily food intake and physical activity, with weight recording using a smart scale on a weekly basis.

Applied Behavior Analysis

Behavior analytic approaches to self-monitoring typically include components that are similar to those in health coaching, such as written behavior logs (Cushing et al., 2011; Kuhl et al, 2015; Kurti & Dallery, 2013; La Londe et al., 2014; Maki et al., 2008; Miller et al., 2018; Zerger et al., 2017), smart phone applications (Bassette et al., 2018; Cushing et al., 2011; Valbuena et al., 2015), and fitness devices (Anrade et al., 2014; Donaldson & Normand, 2009;

Hayes & Van Camp, 2015; Kuhl et al., 2015; La Londe et al., 2014; Li et al., 2018; Miller et al., 2018; Normand, 2008; Valbuena et al, 2018; Valbuena et al., 2015; VanWormer, 2004; Wack et al., 2014; Washington et al., 2014; Zerger et al., 2017). Few studies have required participants to monitor their food and beverage intake (Cushing et al., 2011), whereas many studies have had participants monitor their physical activity (Anrade et al., 2014; Bassette et al., 2018; Cushing et al., 2011; Hayes & Van Camp, 2015; Kuhl et al., 2015; Kurti & Dallery, 2013; La Londe et al., 2014; Li et al., 2018; Maki et al., 2008; Miller et al., 2018; Normand, 2008; Valbuena et al, 2018; Valbuena et al., 2015; VanWormer, 2004; Wack et al., 2014; Washington et al., 2014; Zerger et al., 2017). The majority of studies also have had participants record their behavior on a daily basis (Anrade et al., 2014; Cushing et al., 2011; Donaldson & Normand, 2009; Hayes & Van Camp, 2015; Kuhl et al., 2015; Kurti & Dallery, 2013; La Londe et al., 2014; Li et al., 2018; Normand, 2008; Valbuena et al., 2015; VanWormer, 2004; Wack et al., 2014; Washington et al., 2014) and very few incorporate weekly record-keeping (VanWormer, 2004; Wack et al., 2014).

Purpose

Although health coaching methods vary across studies, common components seem to be motivational interviewing, education, goal setting, action planning, and self-monitoring (Bennett et al., 2010; Coughlin et al., 2020; Johnson et al., 2019; Wolever et al., 2013). However, most health coaching studies do not report well-defined self-monitoring methods (Butterworth et al., 2007; Kivelä et al., 2014), and the terminology used to label components varies across interventions (Michie et al., 2011). Additionally, many health coaching studies have methodological issues that threaten internal validity, use designs that rely on evidence based on group effects rather than individual change, and there is a lack of research validating the effectiveness of health coaching, as most studies do not report direct measures of behavior

(Kivelä et al., 2014; Olsen & Nesbitt, 2010). Furthermore, the effects of individual components within health coaching interventions have not been isolated, so it is unclear what components or combination of components of health coaching are effective (Kivelä et al., 2014). Self-monitoring is considered an integral component of health interventions and has been shown to improve health outcomes (Burke et al., 2011; McBain et al., 2015; Michie et al., 2009); however, the specific effects of self-monitoring as a component of health coaching interventions are unclear. The purpose of this study is to isolate and evaluate the effects of self-monitoring on physical activity within a health coaching package using a single-case experimental design.

CHAPTER 2: METHOD

Evaluating the Effects of Self-Monitoring on Physical Activity Within a Health Coaching Package

Participants and Setting

We recruited three adult women (19–30 years of age) using fliers (Appendix B) posted throughout the community, the University of the Pacific campus, and on the University of the Pacific's wellness center Instagram page. We invited interested individuals to an initial screening meeting to complete the informed consent process (Appendix F), the Physical Activity Readiness Questionnaire (PAR-Q, Appendix C) and the Current Activity Levels Questionnaire (Appendix D). We then asked all prospective participants to sign an agreement stating that they would not use other activity tracking applications or devices (Appendix D) for the duration of their participation. We then provided each participant a Fitbit Inspire 2 fitness tracker covered and sealed with a piece of tape and asked them to wear it for 7 days. During this 7-day screening period, individuals were instructed to wear the Fitbit on the wrist of their non-dominant hand every day from when they wake up until they go to bed. No additional instruction was given.

To be eligible to participate in the study, individuals had to be 18 or older, answer "no" to all questions on the Physical Activity Readiness Questionnaire (PAR-Q, Appendix C), answer "no" to all questions on the Current Activity Levels Questionnaire (Appendix D), have access to a smartphone or computer with internet access, sign an agreement that they would not use other activity tracking applications or devices (Appendix E), and earn fewer than 100 Active Zone Minutes a week. The last inclusionary criterion was chosen because 100 Active Zone Minutes, as measured and calculated by Fitbit devices, is approximate to 100 min of moderate intensity physical activity or 50 min of vigorous intensity physical activity (Fitbit, n.d.-c), which is lower

than what the World Health Organization (2020) currently recommends for adults (i.e., at least 150-300 min of moderate to vigorous intensity physical activity each week).

Those who were younger than 18, answered "yes" to one or more questions on the PAR-Q, answered "yes" to one or more questions on the Current Activity Levels Questionnaire, did not have access to a smartphone or computer with internet access, or did not sign an agreement that they would not use other activity tracking applications or devices were excluded from participating in the study. Those who earned more than 100 Active Zone Minutes a week were to be excluded from participating in the study, however, an exception was made for this criterion due to the four interested participants earning between 125 and 851 total Active Zone Minutes a week.

All four interested individuals met the first five inclusionary criteria (i.e., were 18 or older, answered "no" to all questions on the PAR-Q, answered "no" to all questions on the Current Activity Levels Questionnaire, had access to a smartphone or computer with internet access, signed an agreement that they would not use other activity tracking applications or devices), and the three individuals with the lowest 7-day Active Zone Minute totals from the screening period were selected to participate in the study. We conducted health coaching sessions in-person at the University of the Pacific's psychology department, except for sessions that were conducted via Zoom due to illness or travel.

Materials

We provided participants with a Fitbit Inspire 2 fitness tracker that is equipped with a 3-axis accelerometer and an optical heart rate monitor that tracks steps, distance, calorie expenditure, and Active Zone Minutes (see description below). Two systematic reviews of the validity and reliability of wearable activity trackers reported that Fitbits have high validity and

high interdevice reliability for step count (Evenson et al., 2015; Fuller et al., 2020) and acceptable validity and high interdevice reliability for heart rate (Fuller et al., 2020), which is used to track Active Zone Minutes (Fitbit, n.d.-c). Data on the intradevice reliability of Fitbit devices was insufficient to draw conclusions (Fuller et al., 2020). In addition, Fuller et al., (2020) reported that no specific brand of activity tracker stood out as the best, but that Fitbit devices are the most studied. Van Camp and Berth (2018) evaluated the validity and reliability of Fitbit devices for measuring physical activity such as steps per min and found that Fitbits produced valid and reliable measures of physical activity.

Additionally, in a review of self-monitoring techniques within randomized control trials for weight loss, Patel et al. (2021) reported that rates of engagement with self-monitoring were higher for participants who used digital, passive methods such as wearable devices rather than paper-based, manual forms of self-monitoring. A review of self-monitoring techniques using single-case designs to increase physical activity reported that fitness trackers were the most common technology used with self-monitoring to increase physical activity (Page et al., 2020), therefore a wearable, digital device (i.e., Fitbit Inspire 2) was chosen for self-monitoring.

We reviewed educational materials on health and physical activity from the World Health Organization (WHO) and Centers for Disease Control and Prevention (CDC) with participants during health coaching phases. GraphPad Prism was used to log and graph participant data.

Response Definition and Measurement

The primary and secondary dependent variables were Active Zone Minutes and steps, respectively. Active Zone Minutes are automictically tracked by the Fitbit Inspire 2 and are earned for time spent in specific heart-rate zones. Fat burn, cardio, and peak heart-rate zones are personalized based on an individual's resting heart rate and age. Individuals earn one Active

Zone Minute for each minute they are in the fat burn zone (i.e., engaging in moderate physical activity) and two Active Zone Minutes for each minute they are in the cardio or peak zones (i.e., engaging in vigorous physical activity). Swim activities are the exception because Fitbit devices do not track heart rate during swim workouts; in this case, one Active Zone Minute is earned for each minute of swimming (Fitbit, n.d.-c). Steps are automatically tracked by the Fitbit Inspire 2 using an algorithm that looks for motion patterns and intensity that indicate a person is walking or running (Fitbit, n.d.-a). In a review of self-monitoring techniques within single-subject designs to increase physical activity, Page et al. (2020) reported that walking (step count) was the most common activity monitored.

A tertiary dependent variable was treatment adherence to the intervention, defined as the participant wearing the Fitbit each day; sending their daily step count and Active Zone Minutes to the experimenter at the end of each day; and attending the scheduled weekly health coaching sessions with the experimenter. These data measure participant engagement throughout the study and were calculated as percent of weekly opportunities for each measure (i.e., wearing Fitbit, submitting data, attending health coaching sessions).

Interobserver Agreement and Procedural Integrity

The primary researcher, the advising faculty member, and members of the research lab visually analyzed participant Active Zone Minutes and step count data during weekly formal panel reviews. A secondary observer reviewed random samples of health coaching sessions to verify that health coaching methods were implemented with high integrity. We calculated interobserver agreement (IOA) for intervention integrity for 20% of sessions. A secondary observer also viewed 20% of the recorded health coaching sessions and scored whether the health coaching components occurred (Appendix J). Each instance of the experimenter and

secondary observer scoring the occurrence of a component constituted an agreement, each instance of the experimenter and secondary observer scoring the non-occurrence of a component constituted an agreement, and each instance of the experimenter and secondary observer scoring no opportunity of a component constituted an agreement. The total agreements were divided by the sum of agreements and disagreements and then multiplied by 100 to obtain the IOA percentage. The IOA across all session components was 100%.

Social Validity Measures

At the end of the study, we gave participants the option to receive a final health coaching session and asked them to complete an anonymous Likert-type survey and an open-ended questionnaire (Appendix G) to rate their experience with the study. The survey and questionnaire were delivered online, and the information submitted by the participants was not viewable by the experimenter until after the participants' involvement with the study was complete.

Design and Procedure

The independent variable was instructed self-monitoring within a health-coaching framework, introduced according to a multiple-baseline across participants design. Across all phases of the study, we instructed participants to wear the Fitbit Inspire 2 on the wrist of their non-dominant hand every day from when they woke up until they went to bed. We disabled all built-in prompts and alerts for steps, heart rate, and Active Zone Minutes on the Fitbit devices, which remained disabled for the entirety of the study.

During all health coaching sessions throughout the study, we used techniques that are commonly applied in the health coaching literature: motivational interviewing, education, goal setting, and action planning (Bennett et al., 2010; Coughlin et al., 2020; Johnson et al., 2019; Wolever et al., 2013). Motivational interviewing included a combination of attending to the

participant and directing the conversation to evoke verbal responses in which the participant identified their goals and reasons for change. The experimenter asked open-ended questions, provided affirmative feedback contingent on participant effort and success, rephrased participant's unclear verbal responses, attempted to reinforce participant's verbal responses that indicated motivation to change behavior towards achieving their goal, and summarized key points from the session (Miller & Rollnick, 2002).

Education consisted of printed or vocal delivery of general information about the consequences of behavior, such as health benefits and risks associated with physical activity and sedentary behavior, and information on physical activity recommendations from the WHO and CDC (Michie et al., 2011). Goal setting consisted of prompting the participant to make a behavioral goal (Michie et al., 2011) involving an increase in physical activity. It also included reviewing graphed data of the goal progress and revising the goal if necessary, such as breaking a goal down into an easier to achieve goal. All goals were set by participants. Action planning involved prompting the participant to, at minimum, state a detailed plan of what behaviors they would perform, and when and where they would perform it, including frequency and duration. For some sessions this included providing the participant with information on locations and times in which the target behavior could be performed, and instructions on how to perform the target behavior (Michie et al., 2011). Transcriptions of health coaching sessions are attached (Appendices O and P).

In addition to these components, some health coaching sessions included verbal prompts for the participant to identify barriers, prompting the participant to problem solve, teaching the participant to use prompts, prompting environmental restructuring, planning social support, discussing time management, prompting the participant to reward themselves (i.e., praise)

contingent on progress towards the target behavior, delivering feedback on performance, and delivering praise contingent on successful performance of the target behavior (Michie et al., 2011).

Baseline (Health Coaching)

During baseline, the Fitbit Inspire 2 was covered and sealed with a piece of tape and participants did not have access to their Fitbit account. Participants met with the experimenter for a health coaching session once per week for approximately 30 min over five to six weeks. To control for any self-monitoring that may have occurred following health coaching sessions, we instructed participants to send information about their physical activity at the end of each day via text message with a note of "goal met" or "goal not met," to control for the component of self-monitoring that has been referred to as the delivery of consequences (Nelson & Hayes, 1981). The experimenter responded "received," but provided no additional feedback. Each participant chose how to track their physical activity, but they had to agree that they would not use other digital tracking devices or applications. At the end of baseline, we conducted a semi-structured interview with each participant to gather details on what they did to track physical activity (Appendices K, L, and M). The components of self-monitoring that were present in baseline, as described by Nelson and Hayes (1981), were the recording device (i.e., Fitbit), and consequences delivered by the participant (i.e., stating if their goal was met or not). Once responding was observed to stabilize or move in an undesired direction, the intervention was introduced.

Intervention (Health Coaching + Instructed Self-Monitoring)

Participants continued to wear the Fitbit Inspire 2, but we removed the tape and provided full access to their Fitbit account. While self-monitoring, participants continued meeting with the experimenter for a health coaching session once per week for approximately 30 min over six to

eight weeks. We prompted participants to monitor their behavior (i.e., steps and Active Zone Minutes) throughout the day using the Fitbit device, and we instructed them to send their daily step count and Active Zone Minutes via text message at the end of each day with a note of "goal met" or "goal not met." The experimenter responded "received," but provided no additional feedback. The components of self-monitoring present in this phase were the recording device, the observation of behavior (i.e., attending to step count and Active Zone Minutes on Fitbit), and the delivery of consequences (Nelson & Hayes, 1981).

Social Validity

In the final phase, we gave participants the option to receive a final health coaching session. Whether a participant chose health coaching or not, the self-monitoring procedure was the same as the previous phase, except participants no longer had to send their daily step count and Active Zone Minutes at the end of each day. The components of self-monitoring that were present in this phase were the presence of a recording device and observing behavior (Nelson & Hayes, 1981).

CHAPTER 3: RESULTS

Treatment Integrity

We scored eight health coaching sessions (i.e., three sessions from Participants 1 and 3, and 2 sessions from Participant 2). The experimenter started a session with a check-in with the participant during 88% of sessions (7 of 8), attended to the participant during 100% of sessions, provided education on physical activity recommendations during 100% of sessions, asked open-ended questions during 100% of sessions, rephrased unclear verbal responses during 100% of sessions, and delivered affirmative feedback contingent on effort and success during 100% of sessions. Goal setting occurred during 100% of sessions, action planning occurred during 100% of sessions, and summarizing key points occurred during 100% of sessions. Health coaching sessions were approximately 30 min in duration for 38% of sessions (3 of 8), and the average duration of the health coaching sessions was 23.41 min (range, 13.6–32.54 min). The difference in session duration was due to participant engagement (e.g., how much time the participant spent goal setting, action planning, and discussing barriers). For one of the sessions coded, the recording of the session began after some of the session had taken place, so the check in was not captured on the video recording.

Dependent Variables

Active Zone Minutes

Figure 1 displays total daily Active Zone Minutes for the three participants across screening, baseline, intervention, and social validity phases. Open data points indicate days on which health coaching sessions occurred. The horizontal red line indicates the 7-day moving average of daily Active Zone Minutes, which is the mean of only the most recent 7 days of data

(Valbuena et al., 2017). Horizontal dashed lines indicate the Active Zone Minute goal in place when it was set by the participant. (Note: There are no goal lines during baseline, and there is no goal during the intervention phase for Participant 3, because participants set goals for minutes spent exercising rather than Active Zone Minutes.) The start of baseline was concurrent for all participants; however, all Fitbit data for the first week of baseline was lost for Participant 2 due to an unknown data syncing error.

All participants moved from baseline to intervention (instructed self-monitoring via Fitbit) when a stable trend or trend in an undesired direction was observed in baseline and at least 3 days had passed since previous participants experienced a phase change. We did not observe an increase in level nor trend in daily Active Zone Minutes for any of the participants at the onset of intervention. Therefore, experimental control was not demonstrated. All participants evidenced variable data with overlaps across the baseline and intervention phases, and all participants produced a decreasing trend during the intervention phase, which continued in the social validity phase.

Participant 1 met their self-selected Active Zone Minute goal of 30 per day on 41% of days (20 of 29) during the intervention phase. Prior to setting this goal, Participant 1 earned at least 30 Active Zone Minutes on 77% of days (10 of 13) during the intervention phase, and on 50% of days (18 of 36) during the baseline phase. Overall, there were no changes in level or trend for Active Zone Minutes across phases for Participant 1, and a decreasing trend developed towards the end of the intervention phase (Figure 1). Participant 2 did not meet their weekly Active Zone Minute goals at any point during the study (i.e., 150 Active Zone Minutes, 3 times per week, decreased to 60 Active Zone Minutes 3 times per week). Overall, there were no changes in level or trend for Active Zone Minutes across phases for Participant 2, and a

decreasing trend developed towards the end of the intervention phase (Figure 1). Participant 2 reported illnesses during the study that impacted physical activity, one of which was strep throat (Days 92 – 95). Overall, there was no change in level or trend for Active Zone Minutes for Participant 3, and a decreasing trend developed during the intervention phase (Figure 1). It should be noted that Participant 3 is a college student, and the beginning of the spring semester coincided with day 68 of the study, when we see a decrease in daily Active Zone Minutes.

Figure 3 displays total weekly Active Zone Minutes for the three participants. The horizontal dashed lines filled with yellow indicate the current physical activity recommendation for adults; at least 150-300 min of moderate to vigorous intensity physical activity each week (WHO, 2020). Throughout the baseline phase, Participants 1 and 3 met or exceeded this recommendation (5 of 5 weeks and 6 of 6 weeks, respectively). Participant 2 exceeded the recommendation on 3 of the 5 weeks (60%) in the baseline phase (Participant 2 Fitbit data from the first week of baseline was lost during the Fitbit sync and is therefore excluded). During the intervention phase, Participants 1, 3 and 2 met or exceeded the 150-300 min recommendation on 5 of 8 weeks (63%), 4 of 6 weeks (67%) and 7 of 8 weeks (88%), respectively. No participant met the recommended physical activity levels in the social validity phase. The greatest weekly total Active Zone Minutes for Participants 2 and 3 were during baseline, and the greatest weekly total for Participant 1 was during intervention. The total weekly Active Zone Minutes for all three participants evidenced a decreasing trend across the phases of the study.

Step Count

Figure 2 displays total daily step counts for the three participants across screening, baseline, intervention, and social validity phases. Open data points indicate days on which health coaching sessions occurred. The horizontal red line indicates the 7-day moving average of daily

steps, and horizontal dashed lines indicate the step goal in place when it was set by the participant. (Note: There are no goal lines during baseline for Participants 1 and 3, and there is no goal during the intervention phase for Participant 3, because participants did not set step goals.) The start of baseline was concurrent for all participants; however, all Fitbit data for the first week of baseline was lost for Participant 2 due to an unknown data syncing error, as mentioned above. We did not observe an increase in level or trend in daily step counts for any of the participants at the onset of intervention. Therefore, experimental control was not demonstrated. All participants evidenced variable data with overlaps across the baseline and intervention phases.

Participant 1 met their self-selected step goal of 5,000 per day on 47% of days (29 of 62) during the intervention phase. Prior to setting this goal, Participant 1 reached at least 5,000 steps on 51% of days (7 of 13) during the intervention phase, and on 47% of days (17 of 36) during baseline. Overall, there was no change in level or trend in step count across phases for Participant 1, and a decreasing trend developed towards the end of the intervention phase (Figure 2). Participant 2 met their self-selected step count goal of 8k per day on 3% of days (1 of 30) during the baseline phase, and on 3% of days during the intervention phase (1 of 33). Participant 2 met their self-selected goal of 5,000 steps per day on 38% of days (11 of 29). Overall, there was no change in level or trend for step count across phases for Participant 2, but step count started to increase at the end of the intervention phase (Figure 2). Participant 2 reported illnesses during the study that impacted physical activity, one of which was strep throat (Days 92 – 95). Overall, there was no change in level or trend for step count across phases for Participant 3, and a decreasing trend developed during the intervention phase (Figure 2). As stated above,

Participant 3 is a college student, and the beginning of the spring semester coincided with day 68 of the study, when we see a decrease in daily step count.

Treatment Adherence

Adherence to wearing the Fitbit daily was high across all participants. Participants 1 and 3 each wore their Fitbit on 104 of 105 study days across all phases. Participant 3 wore their Fitbit on 99 of 105 days (94%) across all phases of the study; they did not wear the Fitbit on 4 days that they were ill during the intervention phase. We could not collect Fitbit adherence data during the first week of baseline (Days 8 – 14) for Participant 2 because all Fitbit data was lost during the data sync.

Adherence to sending physical activity updates or data to the experimenter each day was high for Participant 3, who sent their data on 98 of 105 days (93%) across all phases. Participants 1 and 2 had low adherence, sending their data to the experimenter on 12 of 105 days (11%) and 12 of 113 days (11%), respectively. Participant 1 sent data during the intervention phase only, and Participant 2 sent data during the baseline phase only.

Adherence to attending weekly health coaching sessions was high for all participants. Participants 1 and 2 attended 13 of 14 health coaching sessions (93%) across all phases of the study. One health coaching session was missed by both Participants 1 and 2 due to illness, and both participants were unable to reschedule within that week. Participant 3 attended 12 of 12 health coaching sessions (100%) across all phases of the study.

Social Validity

Participants were offered one additional week of health coaching as a measure of social validity. Participants 1 and 2 chose to attend an additional health coaching session in addition to self-monitoring beyond the conclusion of the study. Participant 3 opted out of an additional

health coaching session and chose to only self-monitor. Figure 4 displays participants' rating of agreement with the statements provided on the social validity survey that was distributed to participants at the conclusion of their involvement with the study. Two participants endorsed statements about their health coaching experience (e.g.., "I enjoyed talking with the health coach") between "Agree" and "Strongly Agree." One participant rated "I would recommend health coaching to a friend as "Neither Agree nor Disagree." Two participants endorsed statements about self-monitoring (e.g., "I paid attention to my steps or Active Zone Minutes throughout the day when I wore the Fitbit") between "Agree" and "Strongly Agree." One participant rated "I will continue to use the Fitbit to monitor my physical activity" as "Disagree," and all participants rated "Sending my daily step totals to the health coach helped me achieve my goals" as "Neither Agree nor Disagree." One participant responded "Disagree" to the statement "I was able to achieve my physical activity goals," and the other participants responded, "Neither Agree nor Disagree" and "Agree." All participants rated the statement "I used other apps or devices to monitor my physical activity during the study" as "Strongly Disagree." Participant responses to the open-ended question "Is there any part of the experience you would like to change? If so, what change(s) would you recommend?" were "Was an overall great experience," "None," and "No, I wouldn't change any part of the experience."

CHAPTER 4: DISCUSSION

Over 12 to 16 weeks, we met with three participants for weekly health coaching sessions and introduced instructed self-monitoring using a Fitbit activity monitor. We tracked Active Zone Minutes and steps per day to evaluate the effects of the self-monitoring within a health coaching package. During health coaching sessions, we implemented techniques that are commonly used in the health coaching literature: motivational interviewing, education, goal setting, and action planning (Bennett et al., 2010; Coughlin et al., 2020; Johnson et al., 2019; Wolever et al., 2013). Ultimately, there were no clear changes in physical activity, as measured by Active Zone Minutes and step counts, across the health coaching and instructed self-monitoring phases for any of the three participants.

These findings stand in contrast to those reported in the health coaching literature. In a review of health coaching studies, Kivelä et al. (2014) reported increased physical activity in six of the 10 studies that evaluated behavioral outcomes. Olsen and Nesbitt (2010) reported significant positive effects of health coaching on weight management, physical activity, and nutrition in 40% of the articles they reviewed. Individual studies evaluating the effects of self-monitoring alone have been shown to increase physical activity (e.g., Burke et al., 2011; Critchfield, 1999; VanWormer, 2004), and studies evaluating self-monitoring in combination with other behavior-change techniques have also shown positive outcomes, such as increased step counts (Normand, 2008; VanWormer, 2004).

One difference between the current study and studies reported in the health coaching literature is that we attempted to implement a “best-practice” health coaching method, as most health coaching methods vary across studies (Bennett et al., 2010; Coughlin et al., 2020; Johnson

et al., 2019; Wolever et al., 2013), the terminology used to label components varies across interventions (Michie et al., 2011), and many studies do not report well-defined self-monitoring methods (Butterworth et al., 2007; Kivelä et al., 2014). We implemented the most common components reported: motivational interviewing, health education, goal setting, action planning, and self-monitoring (Bennett et al., 2010; Coughlin et al., 2020; Johnson et al., 2019; Wolever et al., 2013), and we used a taxonomy of behavior change techniques (Michie et al., 2011) to define health coaching components and implement them with high integrity. Even so, health coaching did not appreciably increase physical activity for the participants in our study. This could be due to differences in the characteristics of participants in the current study compared to those from the health coaching literature. For example, Kivelä et al. (2014) reported increased physical activity for patients diagnosed with a chronic disease who received a health coaching intervention. The participants in the current study did not report any diagnoses of chronic disease, and as part of the inclusionary criteria to participate in the study, were required to be able to safely engage in moderate to vigorous physical activity. Additionally, many health coaching studies use designs that rely on evidence based on group effects rather than individual change (Kivelä et al., 2014; Olsen & Nesbitt, 2010), which may obscure individual behavior patterns. Large changes in the behavior of some participants could offset smaller (or no) changes evidenced by other participants.

Because the effects of individual components of health coaching interventions have not been isolated, it is unclear what components or combination of components of health coaching are effective (Kivelä et al., 2014), so the purpose of the current study was to isolate the effects of self-monitoring within a health coaching package. However, even with a best-practice health coaching package delivered with high procedural integrity, there is considerable variability

within and across health coaching sessions, as much of the session is participant-led and the coach's responses are dependent on the participant's verbal initiations and responses. This differs from many behavior-analytic studies that evaluated self-monitoring as a component of a treatment package that included goal-setting and feedback (Normand, 2008; VanWormer, 2004), techniques that can be delivered reliably and consistently because they do not depend as much on the participant's idiosyncratic responses during the coaching sessions. For example, Normand (2008) set participant step goals and delivered brief daily performance feedback via email (e.g., "Good job," "Give a little more effort"), in addition to weekly in-person meetings during which the experimenter delivered vocal and graphic feedback specifically about participant performance.

During the current study, participants set their own goals, and we delivered weekly performance feedback in addition to several other health coaching components (e.g., motivational interviewing, action planning). It is possible that self-monitoring, in combination with experimenter-set goals and daily performance feedback, is more effective than using self-monitoring within a health coaching package. However, Normand (2008) reported that participant performance suggested goal setting was not a critical component of the intervention. Health coaching research from our lab also suggests that there is no difference in physical activity when goals are experimenter-set compared to when they are participant-set (Gibson, 2022), or between directive, experimenter-led and non-directive, participant-led coaching styles (Donohue, 2022). Furthermore, VanWormer (2004) introduced weekly performance feedback in addition to self-monitoring, but it did not enhance the effects of self-monitoring, which suggests that weekly performance feedback was not a critical component of the intervention.

Although participants were instructed to monitor their Active Zone Minutes and step count on the Fitbit throughout the day, Participants 1 and 2 often failed to send their physical activity data to the experimenter at the end of day. In contrast, VanWormer (2004, p. 424) reported anecdotally that "adherence (i.e., recording steps, being available for appointments, attaching graphs) was high for all participants." However, during health coaching sessions in the current study, the two participants who often failed to send their data reported that they still monitored their physical activity throughout the day. Participant 1 reported that they would monitor and engage in movement to reach their daily goal, but they were uncomfortable when they did not reach their goal, so they would not send the data to the health coach (Appendix P). It is possible that for Participant 1, checking the Fitbit and seeing low Active Zone Minutes and step counts after engaging in physical activity had a direct punishing effect for elements of self-monitoring or engaging in physical activity, as she reported being "discouraged" when she would engage in movement but not see the numbers on the Fitbit increase. Private verbal stimuli that described contingencies of punishment may have altered the functional relations of other stimuli and behavior without a history of punishment for that behavior (cf. Schlinger & Blakely, 1987). This could explain the decreasing trend in both Active Zone Minutes and step count during the intervention phase for Participant 1. Interestingly, Participant 3, who did regularly submit their data, reported during health coaching sessions that they did not usually check their Fitbit throughout the day.

Kanfer (1970) proposed that an individual's awareness of their monitored behavior and its controlling variables would make self-monitoring methods clinically powerful tools for behavior change, as observations of one's own behavior may become discriminative stimuli for the monitored behavior. Nelson and Hayes (1981) suggested that the entire self-monitoring

procedure—observing one's own behavior, using recording devices, recording responses, following instructions, delivering consequences, and getting feedback from others—functions as a discriminative stimulus that signals the availability of the ultimate consequences that control responses and result in behavior change.

The consequences that ultimately reinforce the target behavior can be difficult to determine (Cooper et al., 2020) and likely vary across individuals. Nevertheless, the change in target behaviors across studies in which self-monitoring was used as a primary intervention (Burke et al., 2011; Patel et al., 2021; VanWormer, 2004) or as a component of an intervention package (Burke et al., 2011; Normand, 2008; Patel et al., 2021; VanWormer, 2004) suggests that the self-monitoring procedure likely functions as a discriminative stimulus, an establishing operation, or as reinforcement for the target behaviors. When VanWormer (2004) introduced self-monitoring to participants, step counts increased; a reversal (i.e., the removal of self-monitoring) resulted in decreased step counts, thus demonstrating a functional relation between self-monitoring and steps. Normand (2008) reported similar findings with an intervention package composed of self-monitoring, goal setting, and feedback; during the intervention, participants' daily steps increased, and the removal of the intervention resulted in decreased daily steps for 75% of participants. Although the intervention included goal setting and feedback, participants often failed to meet goals, which suggests goal setting was not critical. In addition, VanWormer (2004) showed that e-counseling, which included feedback and goal setting, did not enhance effects of self-monitoring, suggesting that self-monitoring may be the critical component.

The functional relationship between self-monitoring and physical activity has been demonstrated (e.g., VanWormer, 2004) and suggested (e.g., Normand, 2008), but it still is not

clear whether self-monitoring functions as a discriminative stimulus, an establishing operation, as reinforcement, or some combination thereof. For example, monitoring one's daily steps may come to signal the availability of reinforcement for walking more frequently when the individual wears a fitness device and attends to their step count; however, the behavior of self-monitoring may only come to function as discriminative stimuli if there is a history of reinforcement for walking in the presence of the fitness device. Alternatively, if one attends to their step count and notices that it is low, it might then evoke an increase in walking and increase the reinforcing value of seeing additional step counts or taking steps, with the device thereby functioning as an establishing operation (Michael, 1993). In both examples, it's possible that the observation of an increasing step count functions as reinforcement for walking and other behaviors in the same response class while also functioning as punishment for behaviors that are incompatible with the target responses, such as sitting on the couch. The same is true for the potential roles of establishing and abolishing operations.

Another explanation is that self-monitoring is a rule-governed phenomenon that may function as a discriminative stimulus, establishing operation, or reinforcement because of verbal mediation. This phenomenon was described in Schlinger and Blakely (1987) as contingency-specifying stimuli (CSSs), whereby verbal stimuli that describe contingencies of reinforcement or punishment alter the functional relations of other stimuli and behavior without a history of reinforcement for that behavior. A CSS may have a discriminative effect, alter an evocative function, alter the efficacy of reinforcers and punishers, and imbue a neutral stimulus with reinforcing or punishing properties, all of which can happen separately or simultaneously (Schlinger & Blakely, 1987). It is possible that the entire self-monitoring procedure, or specific elements of self-monitoring, may have functional relations with physical activity due to verbal

CSSs rather than a history of reinforcement. Still, it is difficult to accurately determine how self-monitoring results in the desired behavior change, especially because self-monitoring strategies can vary from study to study.

A limitation to the current study may have been the Fitbit device and the frequency of syncing during the screening and baseline phases. During the screening and baseline phases, there were discrepancies in the Active Zone Minute data reported by the Fitbit and the graphs of the heart rate zone displayed on the Fitbit app for Participant 3. For example, the Fitbit recorded 198 Active Zone Minutes (Figure 1, Day 6) but the graph of the heart rate zones did not display any activity above the light zone (Appendix Q). Active Zone Minutes are automatically tracked by the Fitbit Inspire 2 and are earned for time spent in specific heart-rate zones that are personalized based on an individual's resting heart rate and age. It is unclear if the Fitbit device itself updates this algorithm, or if it relies on connection to the app. During the screening and baseline phases, participants were blind to their data, so they would sync the Fitbit once per week under the supervision of the experimenter. After contacting Fitbit support about the discrepancy, the experimenter was told that the Fitbit will most accurately report heart rate and Active Zone Minutes when the Fitbit device is able to sync with the app regularly. Unfortunately, Fitbit support did not have a resolution for the discrepancy, so the Active Zone Minute data displayed are those that were recorded by the Fitbit. This issue was not observed with the Active Zone Minute data recorded by the Fitbit for the other two participants. Two systematic reviews of the validity and reliability of wearable activity trackers reported that Fitbits have acceptable validity and high interdevice reliability for heart rate (Fuller et al., 2020), which is used to track Active Zone Minutes (Fitbit, n.d.-c), but we do not know if syncing once per week may affect this.

The current study evaluated the effects of self-monitoring on physical activity within a health coaching package. Unlike other studies that evaluated the effects of self-monitoring on physical activity (e.g., Burke et al., 2011; Critchfield, 1999; Normand, 2008; VanWormer, 2004), the current study did not demonstrate an increase in physical activity as an effect of self-monitoring. Still, this research contributes to the health coaching literature as we used direct measures of behavior, implemented clearly defined components with high integrity, and isolated self-monitoring within a single-case multiple-baseline across participants design. Future research should consider investigating a "best-practice" health coaching package with a clinical population using a single-case experimental design, and evaluating the addition of contingency management to increase physical activity when other treatments fail to do so. Additionally, during this study, all automated prompts and notifications (i.e., hourly reminders to move, alerts that goals are met) from the Fitbit were disabled, but using such features could serve as antecedent and consequent events for an individual to self-monitor or engage in movement. Future research could evaluate the use of automated prompts and notifications on fitness devices used in self-monitoring interventions to increase physical activity.

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Appendix A: Figures

Figure 1
Daily Active Zone Minute Data

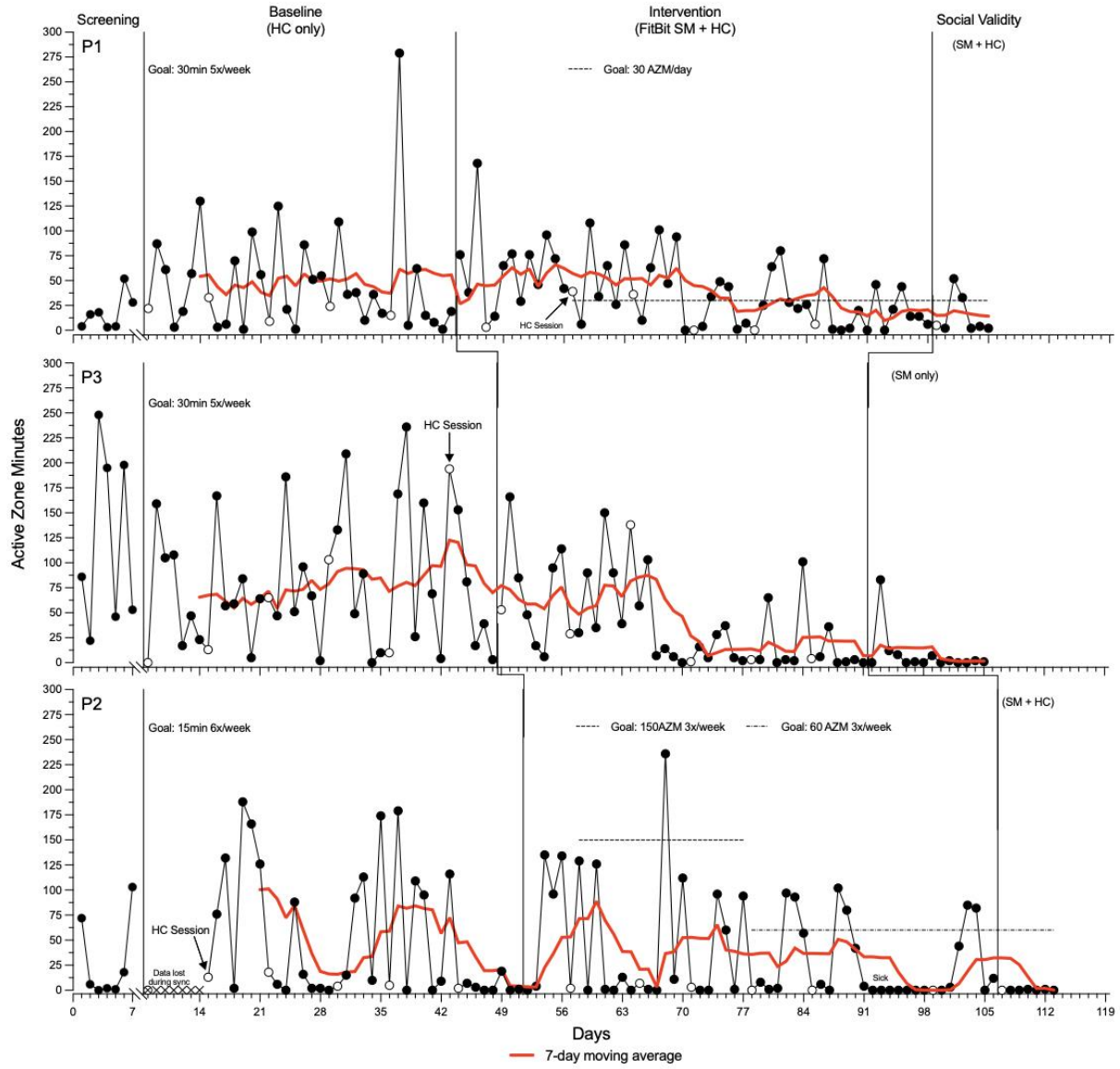


Figure 1 - Open data points indicate days on which health coaching sessions occurred. The horizontal red line indicates the 7-day moving average of daily Active Zone Minutes, which is the mean of only the most recent 7 days of data (Valbuena et al., 2017).

Figure 2
Daily Step Count Data

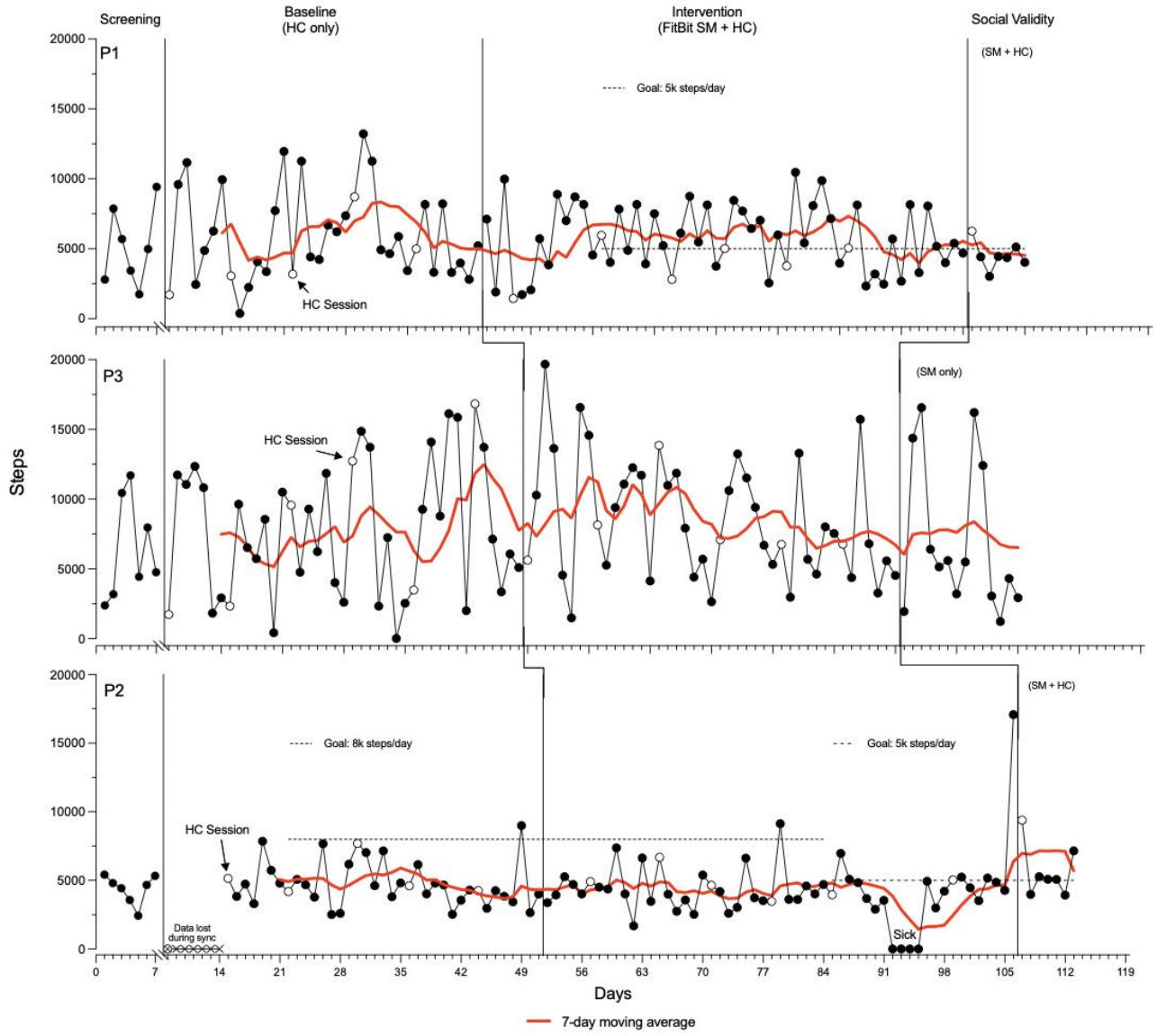


Figure 2 - Open data points indicate days on which health coaching sessions occurred. The horizontal red line indicates the 7-day moving average of daily Active Zone Minutes, which is the mean of only the most recent 7 days of data (Valbuena et al., 2017).

Figure 3
Weekly Active Zone Minute Data

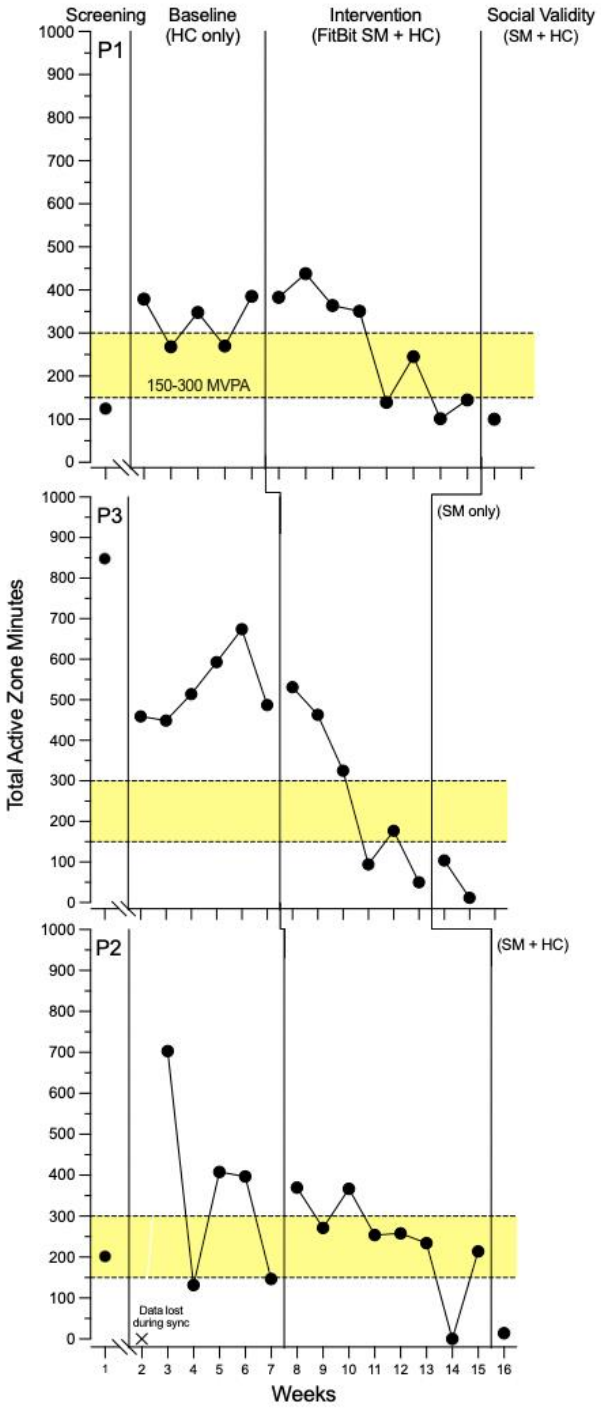
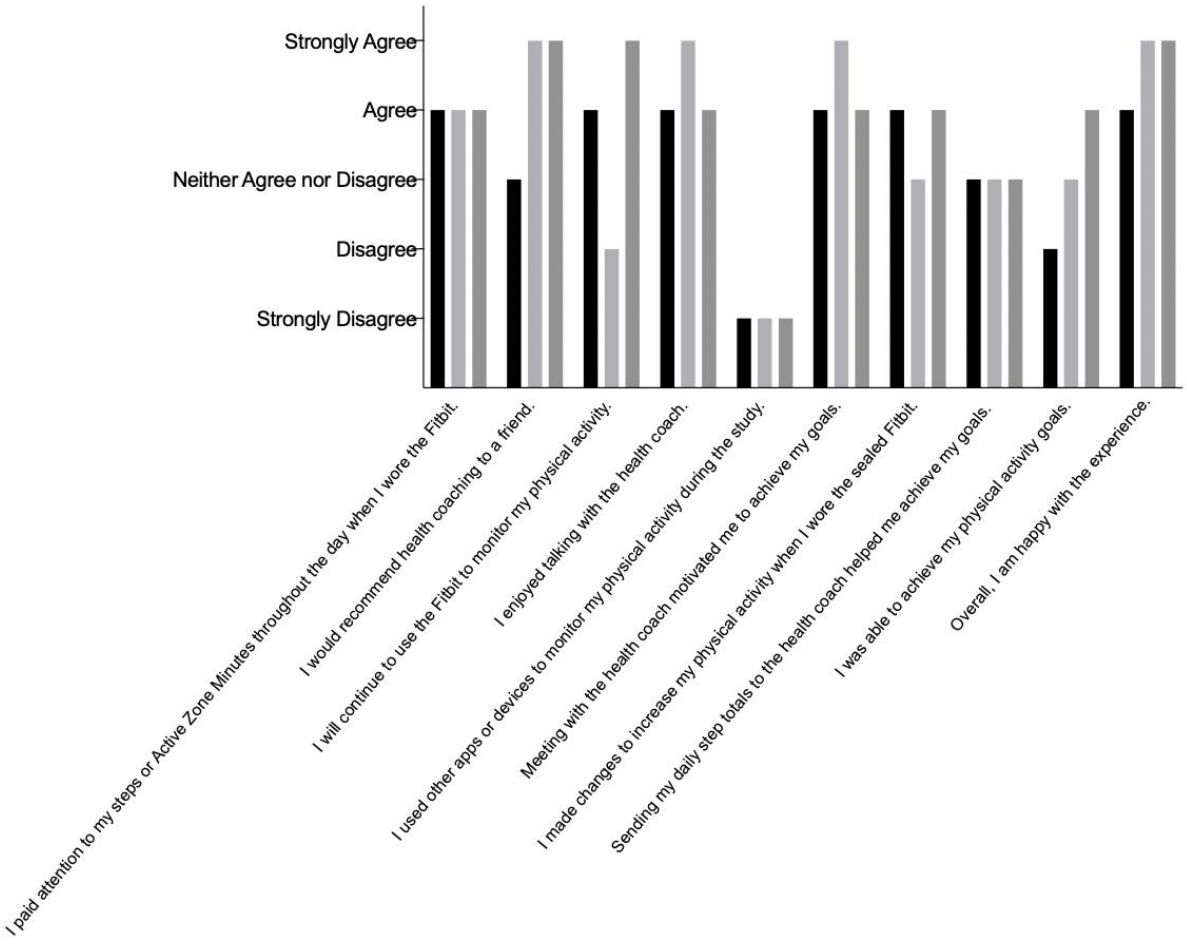


Figure 4
Participant Endorsement of Social Validity Statements



Appendix B: Participant Recruitment Flyer

Appendix C: Physical Activity Readiness Questionnaire

NAME: _____ DATE OF BIRTH: _____ AGE: _____

Please read each question carefully and answer each question honestly.
Information provided on this form will be handled as confidential.

		Yes	**No**
1	Has your doctor ever said that you have a heart condition and that you should only perform physical activity recommended by a doctor?		
2	Do you feel pain in your chest when you perform physical activity?		
3	In the past month, have you had chest pain when you were not performing any physical activity?		
4	Do you lose your balance because of dizziness or do you ever lose consciousness?		
5	Do you have a bone or joint problem that could be made worse by a change in your physical activity?		
6	Is your doctor currently prescribing any medication for your blood pressure or for a heart condition?		
7	Do you know of any other reason why you should not engage in physical activity?		

I, _____ (print name), confirm that the information above is accurate at the time of completing this questionnaire. _____ (sign & date)

If you answered **"No"** honestly to <u>all</u> questions, you can be reasonably sure that you can take part in the physical activity requirement of this research study.

Please note: If your health changes so that you answer **"Yes"** to any of the above questions, notify the investigators and consult your doctor to determine the level of physical activity you can engage in.

Investigator Signature: _____ Date: _____

Appendix D: Current Activity Levels Questionnaire

NAME: _____ DATE OF BIRTH: _____ AGE: _____

Please read each question carefully and answer each question honestly.
Information provided on this form will be handled as confidential.

		Yes	**No**
1	In the last year, have you engaged in structured exercise or have a membership to a gym? If yes, describe: _____		
2	Do you engage in vigorous physical activity at least two hours a week? *Examples: jogging, running, playing basketball, riding a bike fast, hiking, kickboxing, high-intensity interval training, aerobics classes*		
3	Do you engage in moderate physical activity at least three hours a week? *Examples: brisk walking, riding a bike, Vinyasa or power yoga, dancing, recreational swimming, doubles tennis, water aerobics classes*		
4	Do you have a job/volunteer work that requires physical effort? If yes, how many hours a week? _____ *Examples: cleaning, yard work/gardening, waiting tables, dog walking, stocking shelves*		
5	Do you currently monitor your physical activity in any way? If yes, describe: _____ *Examples: Apple Watch, Fitbit, digital tracker*		

I, _____ (print name), confirm that the information above is accurate at the time of completing this questionnaire. _____ (sign & date)

Investigator Signature: _____ Date: _____

Appendix E: Study Participation Agreement

NAME: _____ DATE OF BIRTH: _____ AGE: _____

For the duration of my participation in the study, I, _____ (print name), agree to the following (*please initial):*

_____ to have access to a smartphone or computer with internet access.

_____ not to use other activity tracking applications and/or devices.

Signed: _____ Date: _____

Appendix F: Informed Consent

Department of Psychology
RESEARCH SUBJECT'S CONSENT TO PARTICIPATE IN RESEARCH
Evaluating the Effects of Self-Monitoring on Physical Activity within a Health Coaching Package

Name of Lead Researcher: ***Morgan Valois***
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 examine the effects of a behavioral treatment on the physical activity level of adults. Physical activity will be measured as the number of steps you take, and Active Zone Minutes earned. We will use a wearable fitness tracker that records the number of steps you take, and Active Zone Minutes earned each day.

B. Duration of Participation. You will be involved in the study for a total range of 12–16 weeks. During this time, you will be asked to wear a fitness tracker each day, meet with a health coach on a weekly basis, and complete questionnaires.

C. Research Procedures. If you decide to participate, you will be asked to 1) wear the fitness tracker each day for a period of 12 -16 weeks, 2) meet with a health coach on a weekly basis, and 3) complete several questionnaires.

D. Foreseeable Risks. There are some possible risks involved for participants. You may experience discomfort over the course of the study if your goals are not met, or while meeting with the health coach during weekly sessions.
Additionally, there will be physical risks involved for participants which include but are not limited to muscle soreness, sprains, strains, scrapes, and bruises.

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, in particular the benefits may include those associated with an increase in physical activity such as improved aerobic and muscular fitness; reduced risks of high blood pressure and stroke; and prevention of weight gain, diabetes, and heart disease.

F. Alternative Procedures. Your participation is entirely voluntary and your decision whether or not to participate will involve no penalty. If you decide to participate, you are free to discontinue participation at any time without penalty.

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 that can be identified with you.

Upon conclusion of the research study, the data obtained will be maintained in a safe, locked or otherwise secured location and will be destroyed after a period of three 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 and can safely engage in physical activity.

You or your own insurer is responsible for any medical expenses resulting from injuries to you caused by your participation in this research project. If you are a University student or employee covered by a University medical plan, the terms of that plan may apply to such an injury.

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 at 413-672-8716 or m_valois@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 contact the Office of Research & Sponsored Programs, University of the Pacific at (209) 946-3903 or by email at IRB@pacific.edu.

VI. COMPENSATION

You will be offered compensation in the form of keeping the Fitbit Inspire 2 activity tracker (approximately $55 value) you will wear for the duration of your participation in the study (approximately 15 weeks).

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 health coaching 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 G: Social Validity Survey

This survey is anonymous, please answer the following questions honestly.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. I paid attention to my steps or Active Zone Minutes throughout the day when I wore the Fitbit.	1	2	3	4	5
2. I would recommend health coaching to a friend.	1	2	3	4	5
3. I will continue to use the Fitbit to monitor my physical activity.	1	2	3	4	5
4. I enjoyed talking with the health coach.	1	2	3	4	5
5. I used other apps or devices to monitor my physical activity during the study.	1	2	3	4	5
6. Meeting with the health coach motivated me to achieve my goals.	1	2	3	4	5
7. I made changes to increase my physical activity when I wore the sealed Fitbit.	1	2	3	4	5
8. Sending my daily step totals to the health coach helped me achieve my goals.	1	2	3	4	5
9. I was able to achieve my physical activity goals.	1	2	3	4	5
10. Overall, I am happy with the experience.	1	2	3	4	5

Is there any part of the experience you would like to change? If so, what change(s) would you recommend? _____

_____

_____

Appendix H: Health Coaching Task Analysis – First Session

1. Greeting / check-in with participant
2. Education (general information about the consequences of behavior, such as health benefits and risks associated with physical activity and sedentary behavior, and information on physical activity recommendations from the WHO and CDC)
    a. Print outs
    b. Verbal presentation of information
3. Goal setting
    a. Prompt to identify behavioral goal directed towards increase in physical activity
4. Action planning
    a. Prompt to verbally state detailed plan of what behaviors will be performed
        i. When and where the behavior will be performed (frequency & duration)
    b. Provide instructions on how to perform the target behavior (if necessary)
        i. Teach participant to use prompts
        ii. Prompt environmental restructuring
    c. Provide information on locations & times to perform target behavior (if necessary)
        i. Plan social support
        ii. Discuss time management
5. Affirmative feedback contingent on effort and success
    a. Attempt to reinforce verbal responses that indicate motivation to change behavior towards achieving their goal
6. Attend to participant (Facing towards participant, eye contact)
7. Open-ended questions to
    a. Identify reasons to change
    b. Identify goals
    c. Identify barriers
8. Rephrasing of unclear verbal responses
9. Summary of key points
    a. Participant's goal(s)
    b. Participant's barriers
    c. Participant's action plan
10. Session was approximately 30 minutes

Appendix I: Health Coaching Task Analysis – Subsequent Sessions

1. Greeting / check-in with participant
2. Education (general information about the consequences of behavior, such as health benefits and risks associated with physical activity and sedentary behavior, and information on physical activity recommendations from the WHO and CDC)
    a. Verbal presentation of information
3. Goal setting
    a. Review graphed data of goal progress
        i. Deliver performance feedback
    b. Prompt to identify behavioral goal directed towards increase in physical activity
    c. Revision of goal, breaking goal down into easier to achieve goals (if necessary)
4. Action planning
    a. Prompt to verbally state detailed plan of what behaviors will be performed
        i. When and where the behavior will be performed (frequency & duration)
    b. Provide instructions on how to perform the target behavior (if necessary)
        i. Teach participant to use prompts
        ii. Prompt environmental restructuring
    c. Provide information on locations & times to perform target behavior (if necessary)
        i. Plan social support
        ii. Discuss time management
5. Affirmative feedback contingent on effort and success
    a. Deliver praise contingent on successful performance of target behavior
    b. Attempt to reinforce verbal responses that indicate motivation to change behavior towards achieving their goal
6. Attend to participant (Facing towards participant, eye contact)
7. Open-ended questions to
    a. Identify reasons to change
    b. Identify goals
    c. Identify barriers
8. Rephrasing of unclear verbal responses
9. Summary of key points
    a. Participant's goal(s)
    b. Participant's barriers
    c. Participant's action plan
10. Session was approximately 30 minutes

Appendix J – Health Coaching Task Analysis Score Sheet

Session Component Video #__	**Score** + / - / No Opp
Greeting / check-in with participant	
Education (Print outs OR verbal presentation of information from CDC and WHO)	
Goal setting (Review data, deliver feedback)	
Action planning (Prompt detailed plans)	
Affirmative feedback contingent on effort and success	
Attend to participant (facing towards participant, eye contact)	
Open-ended questions (identify reasons to change, goals, barriers)	
Rephrasing of unclear verbal responses	
Summary of key points (goals, barriers, action plan)	
Session was approximately 30 minutes	
% Complete	

Appendix K: Transcription of Post-Baseline Interview (Participant 1)

HC: How would you describe your physical activity this week?

P: Pretty sedentary, I tried being intentional with quick pockets of movement with the resistance band.

HC: What kind of exercises did you do?

P: No formal exercise, but I was active on Saturday at work.

HC: How many times did you exercise?

P: Zero.

HC: During this time that you've been attending health coaching sessions, did you track your exercise?

P: Yes, mentally.

HC: Did you plan any workouts?

P: During health coaching sessions with you.

HC: Did you write it down?

P: I have a note of my action plan in my phone.

HC: What parts of the exercise or activity did you track?

P: None.

HC: Did you record the exercise or activity after you completed it?

P: No.

HC: Is there anything else you did to track your physical activity?

P: No, just going over it in health coaching sessions.

Appendix L: Transcription of Post-Baseline Interview (Participant 2)

HC: How would you describe your physical activity this week?

P: Fairly light.

HC: What kind of exercises did you do?

P: Walking and jogging

HC: How many times did you exercise?

P: One day

HC: Have you tracked your exercise during this time?

P: Yeah, I would write it down on a log and then when I messaged you to confirm completion, well, when I messaged you.

HC: Aside from messaging me, did you do anything else to record completion of activities?

P: Nope, if my app or Apple watch was available, I would depend on that for the visible confirmation of goals met like step count, active minutes, calories, and time.

HC: Okay, and you said you used a log, what specifically did you write down on the log?

P: [showed image of log on phone, Appendix M] It's an old log provided by a former coach for weight training.

HC: For other exercise, like classes you attended, did you track anything?

P: My yoga class app keeps an activity log when I sign up for and attend classes, so I would look on there. They have a reward leader board; you get points for every class booked and taken. I would plan it on my outlook calendar when I knew I could go or make it. I also had a sticky note in my bathroom that says, "get your ass to yoga class," which is the slogan or motto of my studio.

HC: Did you plan workouts in any other way?

P: No.

Appendix M: Transcription of Post-Baseline Interview (Participant 3)

HC: How would you describe your physical activity this week?

P: I did 30 minutes at home, slower paced workouts.

HC: What kind of exercises did you do?

P: Stationary ones like squats, lunges, pushups.

HC: How many times did you exercise?

P: Four.

HC: During this time that you've been attending health coaching sessions, did you track your exercise?

P: No.

HC: Did you plan any workouts?

P: Not really, just reminded myself throughout the day that I need to do it.

HC: Did you write it down?

P: No.

HC: Did you use a calendar?

P: No.

HC: Did you record the exercise or activity after you completed it?

P: No.

HC: Is there anything else you did to track your physical activity?

P: No.

Appendix N: Workout Log Provided by Participant 2

WORKOUT LOG

NEXT LEVEL REVERSE

Date : Total Workout Time :

Muscle Group :

Resistance Training	Set : 1		Set : 2		Set : 3		Set : 4		Set : 5	
EXERCISE	WEIGHT	REPS	WEIGHT	REPS	WEIGHT	REPS	WEIGHT	REPS	WEIGHT	REPS

Cardio :

EXERCISE	DURATION	SPEED	DISTANCE

Date : Total Workout Time :

Muscle Group :

Resistance Training	Set : 1		Set : 2		Set : 3		Set : 4		Set : 5	
EXERCISE	WEIGHT	REPS	WEIGHT	REPS	WEIGHT	REPS	WEIGHT	REPS	WEIGHT	REPS

Cardio :

EXERCISE	DURATION	SPEED	DISTANCE

Appendix O: Transcriptions of Initial Health Coaching Session (Baseline)

Health Coach: How are you doing?

Participant: Man, so you know, I had mentioned that we're traveling. So, we went to Boston and came back, and we literally all got the stomach flu.

HC: I'm glad you're feeling better.

P: Yeah, me too.

HC: So, I'm just going to start by going over these handouts which you can keep. They are from the CDC and the World Health Organization. This first one here is from the CDC; it describes the health benefits of physical activities for adults. The more immediate benefits are improved sleep, less anxiety and reduced blood pressure. The more long-term health benefits are reduced risk of developing dementia, it lowers risk of heart disease, stroke, and type 2 diabetes, lowers the risk of 8 cancers which are listed there. Also reduces risk of weight gain, improves bone health, and reduces risk to falls because it increases balance and coordination. The next one is from the World Health Organization. This is getting into the recommended amount of physical activity that adults should engage in to get those health benefits. So more than 300 min of moderate intensity, aerobic physical activity, or 150 min of the vigorous intensity. So, 150 to 300 minutes at moderate to vigorous levels. In the red here, this is just talking a little bit about the effects of being sedentary. There are detrimental effects at high levels of sedentary behavior, so to avoid this, you want to hit the recommended levels of physical activity I just went over. So really, it's about replacing sedentary time with physical activity at any intensity. Any movement is better than no movement. And then, if you want more information on that there's a PDF file that goes more in depth about the research the recommendations are drawn from. And then this last one is about how to determine if it's moderate to vigorous activity without using any sort of activity tracker like the Fitbit. If you're breathing hard, but you can still have a conversation pretty easily, it's moderate intensity. If you can only say a few words before you have to stop to breathe and catch your breath, then it's vigorous intensity. And anything that gets you moving counts as activity, which could be gardening or cleaning the house. It doesn't have to be a structured exercise program. Any comments or questions?

P: Yeah, the Fitbit, does it stay blinded the whole time?

HC: It will at the start, but not the whole time.

P: Okay.

HC: So, let's talk about why you're here.

P: Yeah, I want to increase my physical activity.

HC: What does your current physical activity look like?

P: I would say, it's inconsistent. I feel like I do like 2 to 3 weeks where I'm like on a routine, I guess. And so that's where it's like a mix of either strength training or yoga. But I feel like, unless, like, I'm going to a class or have set like a specific time to do a workout like the rest of the day is completely set in. so yeah. But I try to like at least engage in some kind of like structured workout, like 3 times a week.

HC: So, would you say, on average, you're currently exercising about 3 times a week with a structured workout?

P: Yes.

HC: What are some of the structured workouts that you do?

P: Well, it's like a yoga class Pilates class and then I'm not the best at like guiding myself through strength training. I usually have my husband kind of lead it for us.

HC: To increase your physical activity, what do you want to do?

P: Like once a week been some kind of strength with heavy weights. But I think my biggest goal is to get more steps. I feel like, even though I'll engage in, you know, workouts, or whatever like, my steps aren't like anything.

HC: Okay. Correct me if I'm wrong, but it sounds like you're more concerned about the throughout the day movement, getting the steps in, rather than not making enough structured classes a week?

P: Yeah, more movement throughout the day.

HC: So, what are some things that you could do to get more steps in throughout the day?

P: I don't know…

HC: What are your current barriers that keep you from getting more movement in during the day?

P: I have a job where I have to sit, so that makes it difficult. And then where I live, like because they do work from home like, I just can't. I'm not in a neighborhood that they've enough to walk outside. So usually, whenever we do want to engage in like walking. We have to go out of our way to find the same space.

HC: Okay. With working from home, are there times during the day when you can go like leave to go somewhere. Or is that not a realistic thing to do?

P: It's not very realistic, just because any green space that we like it's a drive. And then especially for me to bring my kid.

HC: Okay. So, let's try to work on things you can do staying home, because that's where you are during the day, that's when you want to get those steps in. What are some things that you have available in the home to kind of get you moving throughout the day?

P: Yeah, I mean, I could probably like, walk in my yard type of deal. But it's not a lot of opportunity for movement outside of like. just play with my daughter. Unless we are like physically relocating to a safe green space.

HC: Could you try that, walking around the yard?

P: Yeah, I could try it. Yeah. I mean, I think during like midday it's like fine. But it's more of like if I wanted to do an extended walk like several blocks.

HC: So, it sounds like you want to do a long walk, but you have to either leave home, which is not feasible during the day. When you want to get your steps in or you would have to walk around the block, which is also just not safe? Is the street you're on is safe to walk up and down?

P: Yeah, I think so.

HC: Hm, okay. I'm wondering if it's safe enough to walk up and down the street for a couple of laps, rather than one long walk around a block.

P: Yeah, yeah, that's definitely a thought.

HC: How long do you think your street is?

P: I would say, it's probably like less than a quarter mile or about a quarter mile, maybe.

HC: Okay. When do you have some time during the day when you're home to get a little walk in?

P: I mean, it would be like first thing like waking up, or when we have, like our lunch break. Usually, we try to match up. So, we all have lunch at the same time. And that's where we could probably do an extended walk like around the neighborhood.

HC: Okay. So as far as your goal, it sounds like you want to increase your walking. Is a step goal a direction you want to go in?

P: Yeah. Just because I don't want to do like I already do some kind of like high impact stuff.
HC: Okay, good. And walking at a fast enough pace can get you right into that moderate zone. And like we talked about; any movement is better than no movement. So alright, looking at walking. What number of days do you want to try to?

P: Well, we're working towards a goal. Yeah, yeah. Yeah. So, I think I want to do like 3 days of like 15 min like within my neighborhood. Well mostly like my street. And I just to like kind of pilot that out. Like to see if it's achievable. But also like it, do I feel safe?

HC: I think that's a good plan, and that would be like my next question, okay, if you do it once, a you're like, “actually, this isn’t going to work,” what’s the backup plan?

P: I don't know if it's like a complimentary thing, or if it's just an alternative, like setting out 3 evenings a week for like need to do long walks. And usually those are going to be family walks. Yeah. And whenever we do that, like, my goal has been to at least do 2 miles worth of walking distance. So, I think that's good, between 2 and 3. Yeah, yeah, that ends up being around like an hour, I think, depending on the pace.

HC: Okay, so do you want that as the midday plan, or the evening, or are you trying to do both, 3 days a week?

P: So, I want to try the first daily plan. As far as the longer walks, I think that's still a goal. I just don't know if it's like overloading trying to do both.

HC: Okay, so let's start with the daily, so you’ll do this during a lunch break?

P: Or yeah, like morning.

HC: Okay, so anytime during your workday?

P: Yeah.

HC: Okay, so to review, I have that you want to walk for 3 days a week for 15 minutes, within the neighborhood or on your street during your workday, so morning or lunch break.

P: Yes.

HC: Cool, what days do you have in mind?

P: Let's just get 3 doesn't matter which days.

HC: Okay. Yeah. Alright, that sounds good. I wasn't sure if you wanted to do a specific, Monday, Wednesday, Friday, or just go for 3.

P: Each day is different, my work fluctuates, so just going for like, any 3 I think would be easier.

HC: Okay, what barriers might come up that could keep you from reaching this goal, other than feeling unsafe in the neighborhood?

P: I don't think there would be any like physical barriers like as far as like. Oh, well, I guess my kid would be a barrier like if she wants to tag along. Then, yeah, I have to make sure she's dressed to be outside. Then I have to take her in the wagon. Yeah. So you know.

HC: Okay, do you think you'd still be able to do it for 15 minutes? Would time be an issue after that?

P: I think yeah but it's more of a time management issue.

HC: Can you think of any ways to improve the time management around, let's say your lunch break that you want to go for a walk, what can you set up to help with that?

P: [silence, thinking]

HC: What about setting out sneakers for walking so they are more accessible and ready to go? Is there something similar you could do to prepare your kid for the walk?

P: I could like. Say, if I, my kid, doesn't need to be with me, and she's fine being with her dad like I could just take one of the dogs, and that will like help, probably. Improve my sense of safety.

HC: That's a good idea, I like that. Do you have large dogs?

P: Yeah, we have two chocolate labs. But that's also maybe a barrier because if there are stray dogs on the walk then that could cause more problems.

HC: Hmm, okay, good point. And you mentioned your husband, is he home during the day?

P: Yeah.

HC: You mentioned he helps you with strength training, is he a social support for fitness?

P: Yeah, I don't know. Just with weights. Actually, I think my goal is to still do like 1 or 2 days of actual weights. But yeah, he is definitely a facilitator of that. I would say, not directly, but yeah.

HC: In what ways?

P: What do you mean?

HC: Like, does he remind you to join him for exercise, or is it more of instructing you on how to perform the workouts?

P: Yeah, he like guides me through and makes sure I'm doing it without hurting myself.

HC: Okay, that's awesome. And so you also want to add weight training 1 to 2 days a week as a goal? What specific days or times for that?

P: I think I would like to do those on the weekends because we're both off. And we can maximize. Okay, a time limit on that like, I think 30 min is like the minimum we aim for.

HC: And where do you do this?

P: At home, we have a bench.

HC: Awesome.

P: Yeah, it like, makes life so much easier because it's there always.

HC: Great, so we have a time and place for you to get that done.

P: Okay.

HC: Alright. So we have your goals, and your plan. So what's your reason for wanting to increase your physical activity?

P: Well, I don't like that during the day I get to the point where I'm like, oh, like, you know, I'm sore from sitting so long. Okay. yeah, I mean, like, I would say, I'm like, in pretty good health and stuff, and like, I have good endurance. But yeah, it's really just like my lifestyle is so sedentary that, like, I am feeling the effects of like that. Yeah. And so if I could just like increase my mobility more like I feel like, well, not only are those like added health benefits, but then I also don't have to be so concerned about the risk for injury when I actually am like, in a more vigorous like, workout environment. Yeah, so kind of like preparing for like future, like things that I want to do, or just like, you know, with the workout opportunities that I already engaged in, like I noticed just how stiff I am getting into it. And so I have to put in a lot of plan into like stretching but if I could already essentially have my body like needed and ready to go.

HC: Okay, those are good reasons. And it sounds like some physical discomfort has you thinking, "okay, this is a thing that needs to stop," so that's motivating. And hopefully, when you start moving more throughout the day, you'll feel better and that will help you stick to your plan and reaching your goal.

P: Yeah. And I feel like with the sanitary lifestyle like. It's just easier to mindlessly like eat and just not like stimulate yourself in like a beneficial and helpful way. And trying to not feel so sluggish.

HC: Do you enjoy walking and weight training?

P: Yeah, like, I enjoy all kinds of movement. It's like, if I could just do it every day, or you know, as often as possible to truly reap those benefits, because I feel like my healthy practices like are keeping the balance with all of the unhealthy.

HC: Alright cool. So that's what we will work on this week. I'm just going to quickly review the goals that we discussed. The first one is you want to walk 3 days a week for 15 minutes within the neighborhood or on your street during the workday, and this could be morning, or your lunch break. And the other is one or two days of strength training per week for at least 30 minutes, and this will be on the weekends with your husband at home.

P: Yeah.

HC: And the barriers you identified, the neighborhood might be unsafe, and you are uncomfortable walking there.

P: That's like the biggest one cause. Then we're just having to drive to go for a walk for a little bit is not really possible during the workday.

HC: Right. And your plan to help you through this would be to have your sneakers ready by the door, taking the dogs to feel safer, having your husband to do the weights with you, and evening walks or yard movement as some possible back up plans.

P: Yeah.

HC: Did I miss anything? Anything that you want to add?

P: Nope.

HC: Okay, so now to go over the Fitbit. As you know, no more Apple Watch.

P: Sadly [laughs].

HC: You'll wear the Fitbit on your nondominant wrist from when you wake up until you go to bed. When you go to bed, charge the Fitbit. Another thing I want you to do, at the end of every day, send me a text with an update of your physical activity for that day. You can say it anyway that you choose to, as long as you let me know what you did for physical activity that day, and then if you met your goal or not. Any questions?

P: Nope, send you my physical activity like if I walked and then if I met my goal.

HC: Correct. And I'll see you at the same day and time next week?

P: Yeah, sounds good, see you then.

Appendix P: Transcriptions of Subsequent Health Coaching Session (Intervention)

Health Coach: How was this past week?

Participant: I want to say that I didn't meet my goal, but I'm kind of proud that I almost met it. But there was a lot of almosts this week.

HC: Okay.

P: But I'm glad that I still tried.

HC: Yeah, I saw that the numbers were still up there.

P: Yeah

HC: Did you run into any barriers? What happened this week?

P: No, but two of my off days, you know, I have said I wanted to get 5K steps and 30 minutes active.

HC: Mhm.

P: So, two of the off days, especially, I think, Saturday. I was nowhere near my goal. I think I did 6 active minutes on Saturday. And then Wednesday I did try, but I still was short on the 5k. So, all my steps this week were a little low.

HC: Okay, but you still made that effort. And so how are you feeling as far as getting those 30 active zones minutes every day?

P: So, I had an epiphany yesterday. Because I've always wanted to do not necessarily perfect but know that I showed up type of thing. So, I'm like "oh, I have to show up and workout 30 minutes." My point is, yesterday I was like, "okay, I can just get up and walk throughout the day at work." And when I was in the restroom because it's their private restrooms, I would just do jumping jacks, or try to get my heart rate up. And then I would do that every time I went to the restroom. So, then I started feeling good because I wasn't just sedentary for hours at a time. And then also because I could see my numbers going up and I would get my heart rate up. So yeah, that just felt good.

HC: I think that's awesome. I think that's a good way to approach trying to sneak those minutes in when you don't have that that time for a structured walk on the walking pad. And it's making you feel better, too, because now you're getting those breaks away from sitting at a desk and you're getting your heart rate up. So that's great to hear.

P: Yeah. So, I think that'll be more of my approach for next week. I can't say "oh, I don't have time right now, or oh, I can't! I can't! I'll do it later." And then that's what happened on Wednesday because I worked from home on Wednesday. So, I was just in the office all day, in the home office. So, then it was I think it was already 11:50 when I was like "I cannot not try to hit my 30," and so then I think it was 17 minutes before it hit midnight, because then I'm obviously being reset, and so then I just started shaking my body and trying to get, I don't know, some kind of movement going and then I ended up going up to 26 active zone minutes. So, another almost again, it was a lot of almost, but I felt proud that I kept trying. But I kept not meeting my goal, so I don't know. It was kind of mixed feelings.

HC: That's good, though, because you're being aware of your active minutes. And now that you can see them, you're watching throughout the day and saying, "I can sneak some minutes in here and there." And 26 is extremely close to 30. So that is something to be proud of, even making the effort. Being conscious about it is awesome. So, I'm glad that you have found another thing that works for because it sounds some nights you're working late and don't have the time for planned physical activity.

P: And then I don't. I think this is something I have to work on, or maybe you can help me. But, you remember, one of my things was a stepper, right, the stepper thing. So, I did that one night. I can't remember what night that was, but the point is that I felt it wasn't working. I feel I was working out because it's very much a workout. But my heart rate wasn't that up, or my steps obviously weren't so, I feel like I'm kind of obsessed with the data right now. But I want to make sure that it shows since that one day, 2 weeks, 3 weeks ago, but so I think that's why I'm like "okay, where is the line between strength training vibes or whatever the right term is, and active zone minutes and steps, this helps with my balance, coordination." All the things you read off, you know, I don't know.

HC: So, you felt your heart rate was up, but you were looking at your Fitbit, and you -

P: Yeah, I would look at the Fitbit, and it wasn't as if when I get up and shake my body for 10 consecutive minutes, you know, So I'm like, okay…

HC: I get that. I think that is one of the cons of a Fitbit, with something like a stepper, is you're mostly in one place, and because of how it tracks steps, it might not correctly track movement on the stepper. One way is your stride, so if you're on a stepper that's in one spot, it's probably not getting that stride, and another part of that walking movement is arms. How do you move your arms when you walk on the stepper?

P: I was trying to move them because I did notice that, honestly, it's standing almost, so I tried to incorporate something. I did try to incorporate some so I could feel that I was moving. But I think that's still something that I need to settle on. What am I doing? What is my approach here, you know? Am I still doing this for some sort of accolade, in a way, you know, to see the data into how I did that? Or is this, am I doing this because I want to feel strong, I want to feel, you know, I don't know. One time I did the weights. But obviously your heart, it's different. It's not like you're going to get your heart rate up by a lot.

HC: Mhm, yeah, I understand that. So right now, it sounds like you like seeing the data. And you like seeing those numbers going up because it also helps you monitor that you're reaching your goal. But some of the things that you enjoy doing for physical activity, like the weights or stepper, aren't necessarily contributing to that.

P: Mhm.

HC: Okay. What do you feel right now is more important to you? Do you like doing activities where you can see that data increase? Or would you prefer to do something that you enjoy doing, but you might not see that reflected in your data?

P: I think I'll modify the goals a little. Because, as I mentioned, the epiphany of, "oh, I can get these minutes in throughout the day instead of having to carve out that 30 minutes to get those zone minutes." Anyway, I want to pocket them throughout the day and then add, this is where the modification comes in, add some weights throughout the week, and it's okay if they don't show. But I know that all I would have done it, you know, I would have, I would feel good. I would feel stronger.

HC: And that's part of the recommendation, too. So, in addition to getting those 150 to 300 moderates to vigorous minutes a week, is engaging in strength training two times a week. So that's good. And if that's something else that you are interested in doing and want to do, that's great, because it is also building strength which is also important and has its benefits. I like that you're acknowledging that you want to do this, but that you want to find the balance, because you also want to see your data like the steps and active zone minutes increasing throughout the day. So, I think that'd be a good approach.

P: Yeah, I think that's the best. I think I feel good with that conclusion. So, I'll keep the same goals as last week. The 30 minutes a day, 5,000 steps, and then three times. So, for four days doing that.

HC: Okay, I'm sorry. Can you say that one more time?

P: Four days a week I would do 5k steps and 30 active zone minutes, or I'll try. I'll try my best to hit 5k and 30 minutes and then three days… the other 3 days I would do 8k steps and then that will more than likely get my active zone minutes higher.

HC: Okay, I just want to rephrase it and repeat it to you, so I know I have it right. So, at a minimum you want to hit 5,000 steps and 30 active zone minutes each day of the week. But for three days a week, you want to increase to 8,000 steps a day. And-

P: Mhm which will inevitably give me more active zone minutes.
HC: Okay.

P: I think I've triggered 65 active zone minutes when I go higher with my steps. So, whatever, I'm sure it'll pass the 40/50 threshold. and then I'll sprinkle two weight or strength, or stepping, or something. I kind of want to do weight, because I was doing after the turkey trot, when I had that

conversation with that personal trainer, and then I sat here and told you, “Oh, he mentioned I need to strengthen my glutes and my hamstring” and then I was. I did it a couple of times where I targeted those things, and then I was feeling really good. So, I think I'm going to do that again.

HC: Okay, what specific days would you do that?

P: I don’t want to say.

HC: You don’t want to say?

P: I’ll just do it on the days I’m not, um, when I can find time.

HC: Okay, so it will be on days that you have the time, depending on other things going on?

P: I’ll just, um, I'll probably do it the off days from the 8k steps. Because usually when I try to hit the 8k it’s because I’m intentionally going on the walking pad or if I know I'm going to be really active. Like on Sunday. On Sunday, and yesterday, I spent time with my niece and nephews, and both of those days I did really well with active zone and steps and stuff, because we're running around dadada. Ya know? So even if that’s my 8k day, the other two days I can do the strength.

HC: Okay. I think that's a decent plan. And it's good to hear to that there are other things like interacting with family that are getting you up into the 8k and getting those active zone minutes. That’s helpful because it makes it easier and more approachable when you're enjoying the movement, and you don’t have to get on the stepping pad to get these steps in, it can just be other things, which we've seen before. You've had those high step count days from work and family parties, so that’s cool.

P: Yeah.

HC: So, last week I give you an overview of the WHO and CDC physical activity recommendations, and it sounds like that's something you're thinking about often and the health benefits that come with reaching those recommendations.

P: Yeah, so better coordination and balance and helps with like, 8 types of cancer…

HC: I’m glad that you remembered it, you got it down. Ready for data?

P: Yes ma’am.

HC: So first, we're going to take a look at your active zone minutes. This is our eighth health coaching session. So, we're at about day 63.

P: Are you serious? That’s cool. I don't think I've ever done anything this consistently.

HC: It's good that you're sticking with it, really, it's awesome. Okay (presenting graphed data), so this is the last day we met. Out of the last 7 days, you hit your goal 5 out of the 7 days. There's only this one day here, where you had 6 active zone minutes. And then here you had 26, which is close to 30. You were right there. So, 5 out of the 7 days you met the goal, and one day you were pretty much there. And then, looking back at other weeks that we've been doing this, just look at how many of these are lower compared to over here now that you're monitoring yourself. The moving average seems to just have increased a tiny bit, but looking at it day by day, you're getting up there with your active zone minutes.

P: You can tell.

HC: Yeah, you're consistently getting between 25 and 100 active zone minutes a day.

P: A little bit of a higher range.

HC: Exactly, compared to before, which was more variable or inconsistent, and some of those high points from work were contributing to that average being higher. But it's good now that we're seeing that consistent, daily increase.

P: I understand.

HC: So that's awesome. Happy to see it. Now we can take a look at your daily steps.

P: Okay.

HC: Huge increase in this last week. It just jumped; your moving average jumped; and your lowest data points have gone up.

P: Again, very…yeah.

HC: Yeah, That's great. Because you wanted at least 5,000 a day. And -

P: I'm very close.

HC: You're very close. You're getting there. You're getting close and went over the 5k here on these days. Less variability, and a more consistent, higher step count every day. Another great thing to see.

P: Oh yeah. This is crazy. Then you could see…

HC: Yeah, even in the beginning you were getting up there a little bit. But since the last week and a half or so, when you've set your goal for 5,000 steps and have been watching for it with the Fitbit, it's gone higher. So that's awesome.
And now we'll look at your average active zone minutes. So again, we see that now, week by week you are pretty steady with your average active zone minutes per day compared to when you couldn't see your Fitbit, when those points were more variable. So, once you were able to see

your counts, you went a little bit higher than you had at all before, and you're staying up there consistently. Any thoughts about that?
P: No.

HC: Okay, let's look at average steps.

P: And this is just the week data. Right?

HC: This is your daily average across weeks. So, for week 9, I took an average from the days in that week. So, your daily average from all the days in week 9.

P: Okay, math.

HC: Here we see a similar trend again: your step counts were more variable when you couldn't see your Fitbit data. And now your steps have gone up and you're more consistent.

P: Oh, okay, okay, okay, these are, oh, I understand. Okay, I get it. Yes, the average of the week. Yes. So that's why you said, Week 9. Okay, yeah. Okay. Okay.

HC: Yes, so your average is actually above 5,000 a day, it's around 6,000 steps.

P: Yeah.

HC: So, you're doing good getting at least 5,000 a day when we're looking at your average steps. Now this last graph is your total active zone minutes each week. This is the sum of every day within the week. So, week 9, your total active zone minutes –

P: 364?

HC: Yeah. And over here we had 438, 383 -

P: Oh, cool.

HC: So, you're sticking around 400 a week. Whereas before they were more variable, a similar trend to your average active zone minutes. Once you were able to monitor yourself, you increased up to around 400, which is the highest that you've gotten, gone higher, even, and stayed up there. There's not that decrease anymore.

P: And then what are those low points?

HC: Right here?

P: Yeah

HC: 270 and 268.

P: Okay.

HC: That's your total. So even then, when it was lower, you were getting the recommended -

P: From 150 to 300.

HC: Yup. Exactly. And now you've been going over -

P: Do you have the ability to track vigorous versus intermediate?

HC: Yeah, if you want to go on the Fitbit app, I can show you how to look at that.

P: Because I know there are different benefits to the vigorous and whatnot.

HC: So, if you click on your zone minutes…

P: Oh, I see.

HC: It will break it down like this. You can also look at the graph of your heart rate zones. If you go and hit week, it will show you every day of the week, and then right here, where it says "time in zones," you can look at how many of those minutes were moderate, how many of those were vigorous, and then how many were peak.

P: You're not calculating that data?

HC: I'm not graphing it -

P: Because it doesn't matter?

HC: Well, the recommendation is 150 to 300 moderate to vigorous. AS long as you're in that -

P: At least moderate range?

HC: Yeah, so basically, it's broken up like this: the CDC and WHO recommend at least 150 vigorous minutes of physical activity a week, or 300 of moderate. So, if you're in the vigorous zone, you need less. If you're in the moderate zone, you need more. That's the minimum recommendation. The way Fitbit calculates your active zone minutes is when you're in that moderate zone -

P: So, it's already triggering the 300 per say, even if some of it was vigorous.

HC: Yes, but we know that you are in that zone because Fitbit calculates your active zone minutes like this: when you're in the moderate zone, every minute is equal to 1 minute of active zone minutes. But once you get into the vigorous or peak zones, for every minute spent in those zones, they give you 2 active zone minutes, because it's half of what you need in the moderate

zone. So that's why it’s put into one graph, because the Fitbit already calculates for that difference between the zones.

P: Oh, I understand. That makes sense. They kind of do it for you.

HC: Yes. But if you want to see the time you spent in the specific zones, that’s how you can go and look.

P: Okay.

HC: Any questions about the data? You’re doing great, it’s awesome to see.

P: No questions.

HC: Okay. So, we have your goal and action plan. I'm just going to have you review those for me.

P: Okay, so I am going to attempt to hit 5k steps every day with an active zone minute of 30, and then 3 days of the 7 days of the week I will attempt to hit 8,000 steps, which inevitably my active zone minutes will surpass the 30. And now I'm adding 2 strength training days. I don't know what I will be in the mood to do, but I want to add two of strength.

HC: That sounds good. And then what’s your plan for hitting those goals?

P: I think just sticking to walking throughout the day and having those pockets of movement is really helpful to rack up those steps and active zone minutes. I think that's going to be my best approach. And then based on how I'm doing that day, then I will, when I get home, I'll evaluate what I have for my monitoring. If I'm really short on something, well, then, obviously, that means I need to walk. Or I need to do, you know, some kind of movement.

HC: Okay, so you're going to see how you did that day when you get home or when you're done with work. And then, if you haven't met your goal, you'll just add in some activity to hit your goal?

P: Mhm.

HC: Okay, I think that's a good plan. You found that it works for you, looking at this this week's data, it worked well. So that's awesome. And what are some barriers that you see coming up this week for you?

P: Um, none.

HC: How about last week?

P: Nope

HC: It seems like you found a way around your work schedule to still get movement in, and that's probably the biggest barrier we've identified, that you have to sit at work sometimes for long periods, so that's awesome.

P: All my work is sedentary, so, and then I've been really booked and busy with work as in, there's a lot going on so I have to be at my desk. I also really enjoyed wearing my Hogas yesterday, I felt I just needed to walk. So I think I'll start using my tennis shoes, my workout shoes, throughout the week. And then that way it gets me in the mood of "just use 'em," ya know?

HC: Okay, I think that's a good plan, too. So that you'll already be wearing the right, comfortable footwear to do what you need to do to move.

P: I should get more different colors and stuff. But that's, anyway, that's irrelevant. The point is that I want to start wearing my workout shoes.

HC: That's a good plan. Okay, and just a reminder that at the end of the day, when you look at your data, send me a text with your total active zone minutes and steps, and goal met or not met.

P: Do I have to say I met the goal? I don't want to send that part.

HC: You don't want to say if you met the goal?

P: I just want to provide the data.

HC: Why don't you want to say anything about the goal?

P: Because I get really in my head, if say, I'm 26 minutes and 4,000 steps or 3,000, whatever it was, I'm going to feel like I did nothing, you know? So, then it adds a little bit of personal discomfort. So, I think I avoid it. So, to not avoid it, I'll just send you data. And if I feel amazing about it, which I did not feel amazing about any one of my days last week, so then if I feel like I killed it that day, I met my 8k, or whatever my 5k, 30 minutes, then I'll say, "yeah, it was met."

HC: When you feel that discomfort, what generally happens as far as you continuing to try to reach your goals?

P: I feel a little bit more pressure because I'm… Okay, yesterday I didn't, which I feel that pressure keeps me moving. But I think it's the sending you the text because I have an alarm to send it to you. But even the other day, when it went off on Wednesday, I was still working. I worked really late that day. But the point is that they reminded me to, like, "okay, okay, you need to get up and finish this," then I was like, "I know but I'm too busy." So, then I kept working, and then 11:50 came around or 11:40, whatever it was. And then I was like, "okay, no, I cannot not do this." And then that's when I took some time to move my body. And that's when I hit the 26, and I felt really proud of myself. But I felt really bad that I didn't hit the 30, and then I didn't hit the 5k, I think I was 3,900 that day. So, even though I knew I had to text you, I saw I did nothing, it wasn't what I needed it to be. So, I think I'll just send you the active zone and the

steps. And then, yeah. Keep it dry. Because then I get my emotions involved. And that's why I don't want to.

HC: It's good that you identified that. You know what's going to help you to continue to work towards the goal and what might make you feel defeated and get in that negative space -

P: Because apparently, I did amazing. But I felt even when I walked in, I was, well, it wasn't great, you know?

HC: But you did the best that you have done, as far as meeting your goals and consistency with your steps and minutes. So, you did do good. Try to remember that, even when you don't feel like you're doing good, remember that you're more consistent with both higher step counts and active zone minutes, and you met your goal 5 out of 7 days. Going for a 7 out of 7 days at 30 active zone minutes a day, you were really reaching for it, you know, so to hit 5 out of 7 is awesome. And your weekly total actually went higher, as we saw, than that recommendation. So, you're doing good.

P: Yeah.

HC: Okay, so that wraps our time up. What time for next Friday?

P: Probably the same time, 8:30, if you can.

HC: Okay, yeah, I'll move it right now.

Appendix Q: Screenshot of Participant 3 Active Zone Minute Heart Rate Graph