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Feasibility of an Intervention for Men on Androgen Deprivation Therapy: A Research Protocol

Alana Manson, MS¹, Jamie Myers, PhD, RN, AOCNS®¹, Sandra Billinger, PhD, PT, FAHA², Jaimie Ward, MS², William Parker, MD³, Jill Hamilton-Reeves, PhD, RD, CSO³, Carrie Michel, MS, RD, CSO³, Sally L. Maliski, PhD, RN, FAAN¹

¹School of Nursing, University of Kansas Medical Center

²Department of Physical Therapy and Rehabilitation Science, University of Kansas Medical Center

³Department of Urology, University of Kansas Medical Center

Abstract

Androgen deprivation therapy (ADT) is a treatment used across the prostate cancer disease spectrum and works by suppressing testicular androgen production to castrate levels. Although ADT can provide survival benefits, it is also associated with increased risk for cardiovascular disease, metabolic syndrome, increased visceral fat mass, dyslipidemia, decreased arterial compliance, and diminished health-related quality of life. The Staying Strong and Healthy protocol is a telephone-delivered intervention led by a nurse coordinator to minimize the increased cardiovascular and metabolic risks associated with ADT. This research will evaluate the feasibility of the protocol and provides the foundation for future behavioral interventions across diverse populations of men on ADT.

Keywords

cancer; quality of life; lifestyle change; exercise; nutrition

Introduction

Prostate cancer (PC) is the most common non-cutaneous cancer among men in the United States (American Cancer Society, 2018). Androgen deprivation therapy (ADT) is one form of treatment for PC. ADT suppresses androgen production to castrate levels, which may result in decreased tumor volume, palliation of metastatic symptoms, and improved survival time (Donovan, Walker, Wassersug, Thompson, & Robinson, 2015; Hou & Flaig, 2012; Shahinian, Kuo, Freeman, Orihuela, & Goodwin, 2005). ADT can be utilized in a variety of ways across the PC treatment spectrum, with approximately 50% of PC patients receiving

Correspondence: Alana Manson, School of Nursing, University of Kansas Medical Center, 3901 Rainbow Boulevard, G040, Kansas City, KS 66160, amanson2@kumc.edu.

<https://ClinicalTrials.gov/> registration

Conflicts of Interest

The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

ADT during the trajectory of their disease (Shahinian et al., 2005; Sharifi, Gulley, & Dahut, 2005). Evidence-based treatment for early stage PC includes surgery, radiation therapy with or without adjuvant ADT, or active surveillance. However, after recurrence or in the management of advanced disease, ADT often becomes the mainstay of therapy and can be lifelong (Levine et al., 2010; Punnen et al., 2013; Pagliarulo et al., 2012).

Although survival benefits have been demonstrated with ADT, it is associated with many adverse side effects and health risks. Physical side effects include, but are not limited to, hot flashes, fatigue, and urinary, bowel, and sexual dysfunction (Carlsson et al., 2016; Taylor, Canfield & Du, 2009). Furthermore, androgen suppression, with its inherent impact on metabolic and endocrine function, places men at increased risk for cardiovascular disease, metabolic syndrome, and diabetes (Braunstein, Chen, Loffredo, Kantoff, & D'Amico, 2014; Salvador et al., 2013; Keating, O'Malley, Freedland, & Smith, 2012). These risks are manifested as increased body mass index (BMI), visceral fat deposition, increased insulin resistance, decreased lean muscle mass, increased serum low-density lipoprotein levels, and decreased arterial compliance. The increase in visceral fat and decrease in lean mass also contribute to the development of insulin resistance, often within a few months of initiating ADT (Dorff et al., 2017; Nguyen et al., 2015; van Londen, Levy, Perera, Nelson, & Greenspan, 2008). Research has demonstrated that within a year of starting ADT, men have a 20% higher risk for cardiovascular morbidity, including myocardial infarction and congestive heart failure (Levine et al., 2010; Van Hemelrijck, et al., 2010). Additionally, cognitive performance, particularly related to verbal fluency, visual recognition, and visual memory, have been shown to decline with decreases in testosterone and estradiol associated with ADT (Gonzalez et al., 2015; Salminen, Portin, Koskinen, Helenius, & Nurmi, 2004; Wu et al., 2016).

Indeed, treatment-related physical and emotional side effects increase the risk of poorer health-related quality of life (HRQOL) for men receiving ADT (Alibhai et al., 2015; Sevilla, Maliski, Kwan, Connor, & Litwin, 2012). Psychosocial adverse effects include depression, anxiety, malaise, fatigue, and memory difficulties (Lee et al., 2015; Shahinian et al., 2005). Furthermore, the decreased libido and erectile dysfunction associated with ADT threaten masculine identity and psychological adjustment (Tsang, Skead, Wassersug, & Palmer-Hague, 2019; Wassersug, 2009). Taken together, the potential long duration of ADT and its cumulative effect on both physical and emotional domains combine to result in a significant decline in HRQOL over time (Zavala et al., 2008; Sevilla et al., 2012). In order to improve symptom management, researchers have explored interventions using physical activity and/or nutrition to mitigate side effects of ADT.

Exercise

Exercise has received attention as a therapeutic intervention to attenuate adverse effects of ADT. However, the current evidence is inconsistent regarding which side effects of ADT are improved independently by exercise interventions. These discrepancies may be due to various reasons. For example, type of intervention (resistance versus aerobic training) and study type (randomized controlled trials (RCTs) versus uncontrolled) have led to different conclusions. Resistance training alone has been shown to either increase lean muscle mass

or decrease the decline of lean muscle mass, decrease body weight, and decrease BMI, all resulting in indirect positive effects on health and HRQOL (Galvão, Taaffe, Spry, Josheph, & Newton, 2010; Segal et al., 2003). However, RCTs incorporating both resistance and aerobic activity may be most beneficial for the ADT population as the combination has shown to improve: physiologic measures such as maximal oxygen consumption ($\dot{V}O_2$ max), estimated peak oxygen consumption ($\dot{V}O_2$ peak), and fat oxidation; blood biomarkers including total serum cholesterol and the total cholesterol to high-density lipoprotein ratio; body composition; sexual function; fatigue; and HRQOL (Cormie et al., 2015; Wall et al., 2017; Yunfeng, Weiyang, Xueyang, Yilong, & Xin, 2017). Additionally, the feasibility and durability of exercise regimens are not well established. Motivation and adherence are common obstacles with exercise interventions (Buffart et al., 2014; Knols, Aaronson, Uebelhart, Fransen, & Aufdemkampe, 2005).

Nutrition

Evidence-based nutrition guidelines for reducing treatment-related side effects specific to prostate cancer patients are limited. Accordingly, there is no standardization in approach to diet and nutritional quality manipulation for studies within the ADT population. As there are few RCTs implementing nutrition-only interventions, isolating the effects of nutrition on ADT-related symptoms is difficult. For example, a recent literature review reported only one nutrition-based intervention trial, and the study reported improving fatigue and quality of life (QOL) in PC patients on ADT (Baguley, Skinner, Leveritt, & Wright, 2017).

Emerging evidence demonstrates that there may be a synergistic effect of improved lifestyle behaviors through enhanced dietary quality and consistent exercise relative to standard of care procedures for men on ADT (Bourke et al., 2011; Bourke et al., 2014). One RCT intervention study that implemented a low-carbohydrate diet in addition to walking demonstrated significant improvements in weight loss, insulin sensitivity, high-density lipoprotein levels, and triglyceride levels (Freedland et al., 2019). Another RCT by O'Neill et al. (2015), which implemented a calorie-controlled diet in addition to physical activity among prostate cancer patients receiving ADT, yielded improvements in weight, BMI, fat mass, waist-to-hip ratio, muscle mass, fatigue, QOL, and stress levels. The foundation and development of our pilot study was based on this body of literature regarding exercise and nutrition to mitigate the side effects of ADT.

Pilot Study

Our previous qualitative work has shown that men who are starting ADT are interested in making changes that will improve their health, as are the spouses of the married men (Maliski, Rivera, Connor, Lopez, & Litwin, 2008). We also found that men were unable to identify effects of ADT other than hot flashes and sexual dysfunction. These findings may suggest a lack of counseling and/or awareness of the metabolic effects among those receiving ADT. Therefore, the time of ADT initiation may represent an ideal window to 1) provide education and coaching to facilitate understanding of ADT and its effects and 2) promote the adoption of healthy behaviors which may mitigate adverse side effects.

Current Study

The development and testing of intervention strategies are critical to maximize this potentially “teachable moment” as a means to manage and minimize risk through healthy behaviors. Based on the results of our pilot data, a three-pronged intervention was developed to elicit desirable behavior changes to reduce the risks of cardiovascular disease and metabolic syndrome in men receiving ADT. Specifically, the intervention encompasses aerobic and resistance exercise, an in-depth nutrition curriculum, and education regarding how ADT works and the accompanying side effects. This study is novel as the intervention is tailored to each individual’s current level of physical activity and diet quality, progressing participants steadily over time. Additionally, the education portion of the intervention may reinforce a deeper understanding of ADT-related side effects and provide sustained motivation to maintain behavioral changes.

The purpose of this study is to evaluate the feasibility of a nurse coordinator led, telephone-delivered intervention designed to minimize the increased cardiovascular and metabolic risks associated with ADT. Primary Aim 1 is to compare pre- and post-intervention BMI, lipids, waist/hip circumference, and fasting blood glucose within and between intervention and control groups. Primary Aim 2 is to compare pre- and post-intervention HRQOL using the Short Form-12 subscales of emotional and physical well-being and disease-specific HRQOL using the Expanded Prostate Cancer Index Composite within and between groups. Primary Aim 3 is to develop and compare explanatory models of men’s activity and nutrition choices between groups. Primary Aim 4 is to evaluate the acceptability and benefit of the intervention with individual qualitative interviews.

Methods

The Staying Strong & Healthy protocol is a 2-arm randomized controlled trial comparing an intervention group with an attention control group. A qualitative component using a constructivist grounded theory design is also incorporated. Primary outcome measures include calculated BMI, waist-to-hip circumference, lipid levels, fasting blood glucose levels, and HRQOL at baseline, 6 months, and 12 months (see Table 1). The target sample size is 45 participants. As this is an exploratory, proof of concept study, an effect size computation was not necessary. This study is approved by the University of Kansas Medical Center (KUMC) Institutional Review Board.

Recruitment, Eligibility, and Randomization

Participants are recruited primarily through urology, internal medicine, medical oncology, and radiation oncology clinics at KUMC. The research manager screens referrals via electronic medical record review. Eligible participants are 1) male 2) over the age of 21 years 3) diagnosed with prostate cancer 4) starting or have started ADT treatment within the last 3 months 5) reinitiating ADT after duration on ADT holiday exceeds time on ADT 6) able to speak and read in English or Spanish 7) consistently reachable by telephone 8) able to travel to the institution for data collection. Though men are not necessarily excluded based on pre-existing cardiac and metabolic conditions, the research manager screens potential participants with goodness of fit and participant safety in mind. After eligibility is

confirmed, the research manager initiates phone contact to ascertain interest in participation. If desired, the study consent form is provided via email or postal mail in advance for review and questions.

Before initiation of any study procedures, the nurse coordinator obtains written informed consent in-person. Following consent, each participant is randomly assigned to the experimental or attention control group. The randomization scheme involves a 1:1 allocation ratio developed by the study statistician. The study is not blinded.

Intervention Procedures

Baseline visit—All study procedures take place at KUMC's Clinical and Translational Science Unit. The nurse coordinator reviews the study and consent form in the participants' preferred language, confirms understanding by having the participant explain the consent form in his own words, and obtains signed consent. Fasting blood work is drawn and the participant is provided with a small snack. The nurse coordinator obtains blood pressure, heart rate (HR), height and weight, hip and waist circumference, lifestyle information, current medications, and administers the study questionnaires. A registered dietitian interviews the participant to gather a 24-hour dietary recall. The dietitian provides a prescription and discusses nutrition-based goals for the following week. Next, the participant completes a one repetition maximum (RM) test for upper and lower body strength under the supervision of the study physical therapist. Following a short rest period, the participant then performs a treadmill graded exercise test (GXT) under the guidance of an exercise physiologist. The GXT is used to assess $\dot{V}O_2$ peak as an index of aerobic capacity. Using the one RM and GXT data, the participant is given a brief personal training session to educate them about the strength training and cardiovascular workouts to be completed over the next 12 months. The participant is then provided with a set of resistance bands and is instructed on how to train with the bands. All participants must demonstrate proper form prior to concluding the session.

At the end of the baseline data collection, the nurse coordinator instructs the participant on the use of the study smartphone and HR monitor. The phone contains pre-downloaded material, including the nutrition curriculum and pictures of resistance exercises to be completed throughout the duration of the study. Upon completion of the baseline visit, participants receive a pre-loaded \$25 gift card to thank them for their time and participation. The nurse coordinator schedules the first weekly phone call, answers any outstanding questions, and escorts the participant out of the facility.

Exercise testing—During the GXT testing, breath-by-breath ventilation and expired gases are measured using a metabolic measurement system. Participants are set up with a 12-lead electrocardiogram to monitor HR and fitted with a facemask to allow simultaneous breathing at the mouth and nose. Prior to commencement of exercise testing, resting HR is obtained from a seated position and monitored throughout the exercise test using a cardiac stress test system. The exercise physiologist conducts an initial orientation to a brisk, comfortable walking pace that results in a rate of perceived exertion of 11 on the 6–20 Borg scale. Once the starting pace and grade are determined, these parameters are used as the starting pace

and grade for all subsequent GXT. The participant then rests in a seated position while the exercise physiologist provides a thorough explanation of GXT. The participant's HR returns to within 10 beats of resting HR prior to the commencement of the GXT.

For GXT, the pace remains constant throughout the test while the grade is increased 2% every 2 minutes until the following criteria are met: 1) participant elects to terminate the test 2) the exercise physiologist determines that $\dot{V}O_2$ max has been reached based on the American College of Sports Medicine's criteria or 3) the presence of test termination criteria (i.e., sustained ventricular tachycardia, moderately severe angina, drop in systolic blood pressure of more than 10mmHg with increased work rate) according to the American College of Sports Medicine guidelines (American College of Sports Medicine, Thompson, Gordon, & Pescatello, 2010). Participants are instructed not to hold onto the handrails during the test but may use fingers or light touch for balance. At the end of the GXT, peak $\dot{V}O_2$, peak HR, peak metabolic equivalents, maximum respiratory gas exchange ratio, maximum rate of perceived exertion, test time, and participant effort are recorded, and the participant begins the cool down phase of the GXT.

One RM for upper body is performed using a chest press machine and one RM for lower body is performed using a leg press machine. The one RM assessment starts with light weight and 8–10 repetitions as a warm up. Weight is increased gradually, and repetitions decrease until the participant can only perform one repetition. The participant rests between 30 seconds and one minute between each set.

The exercise intervention includes twelve resistance exercises that target large muscle groups of the upper and lower body (see Table 2). The study physical therapist prescribes a 12-week progressive exercise program (see Table 3). The resistance bands provided to the participant include five bands, as well as two ankle straps and a door anchor. The resistance bands set consist of 3 lbs, 5 lbs, 8 lbs, 13 lbs, and 19 lbs and can be linked together for a total combined weight of 96 lbs. Recommendations for the beginning resistance weight, number of repetitions, and sets for each of the twelve exercises are based on each participant's fitness assessment. As the participant progresses, the program is tailored to their individual capabilities. Participants are advised to complete resistance exercises on three non-consecutive days per week and aerobic exercise (i.e., cycle or walk) two days per week. Incremental exercise progression occurs during the intervention phone calls.

Nutrition assessment and counseling—The 24-hour dietary recall follows the five-step multiple pass interview approach. The first step is an unstructured, uninterrupted listing of all foods and beverages consumed. The next three steps use a structured approach to data collection, including memory cues. The final probe step is an unstructured question for any other foods recalled and includes several additional memory cues (Shim, Oh, & Kim, 2014). The registered dietitian then leads the participant through a 30-minute diet and nutrition coaching session where individual baseline nutrition goals are set for the following week. The objectives of the dietary component are consistent with the guidelines published by the American Heart Association and American College of Cardiology guidelines on lifestyle to reduce cardiovascular risk and the American Institute of Cancer Research for cancer

survivorship (Eckel et al., 2013; Wiseman, 2008; World Cancer Research Fund International, 2014). The curriculum focuses on the American Institute of Cancer Research healthy eating plate, portion control, increasing intake of non-starchy vegetables, ample protein emphasizing fish and plant-based proteins, eating for better blood sugar control, reducing intake of trans-fats, and cooking techniques to avoid charring. The curriculum materials, which are downloaded on the study phones, represent male characteristics in images and wording and reflect the values and barriers perceived by men. This behavior-based curriculum is grounded in social cognitive theory, problem-solving theory, and relapse prevention (Bandura, 2004).

Phone calls—Following the baseline study visit, intervention participants receive 12 weekly telephone calls followed by 3 monthly calls for a total of 6 months. Phone calls typically last 30–40 minutes. The call content follows the previously piloted curriculum. The nurse coordinator is responsible for facilitating the call with participation by the registered dietitian and physical therapist. Participants report the status of progress with the aerobic and resistance exercises, HR values during aerobic exercise, and dietary behavior changes. Fitness and nutritional goals are mutually agreed upon for the following week. The nurse asks open ended questions to assess for any adverse events related to study participation. In the event that an adverse event is identified, best clinical practices and clinical judgement are used to move forward. All study team members are informed of adverse events and are kept up to date regarding management and outcomes. The nurse coordinator leads a discussion of the educational content for each session, including the weekly modules from the nutrition curriculum and general education about ADT and its cardiovascular and metabolic side effects. During the phone calls, the nurse coordinator aims to establish a supportive and trusting relationship with the participant to facilitate accurate data collection and intervention adherence. Participants are encouraged to contact the nurse coordinator at any time with questions or concerns about the study or their ADT.

Follow up visits—The 6- and 12-month visits are identical to the baseline visit except for consent form review and the nutrition and physical exercise counseling sessions. Participants receive \$50 and \$75 gift cards for their participation at respective 6- and 12-month visits. Study smartphones, HR monitor, and resistance bands are returned at the 12-month visit. Participants are encouraged to reach out to the study manager or nurse coordinator with questions between the follow up visits; however, the study team does not initiate contact aside from visit scheduling. See Table 4 for data collection measures.

Attention Control Procedures

Baseline visit—Study procedures for the attention control group baseline visit are identical to the intervention group, excluding the 30-minute diet and nutrition coaching session, fitness assessment, and fitness prescription. Attention control participants do not receive the study smartphone, exercise bands, or HR monitor. No goals are set for exercise or dietary behaviors. At the completion of the baseline data collection, the nurse coordinator provides instructions on how to access online education about prostate cancer and ADT. Links are provided to the Us Too and Improving Access, Counseling, and Treatment prostate cancer advocacy websites. Upon completion of the baseline visit, participants receive a \$25

gift card to thank them for their time and participation. The nurse coordinator schedules the first monthly phone call, answers any outstanding questions, and escorts the participant out.

Phone calls—Preceding each call, participants are provided with previously piloted general education about prostate cancer and ADT sent via email or postal mail. These educational modules are discussed on the phone calls and cover some of the same general topic areas as the intervention, but in much less depth without guidance for specific dietary and exercise behavior changes. Participants are assessed for any adverse events using the same protocol as with the intervention group. As with the intervention participants, the nurse coordinator endeavors to establish a supportive and trusting relationship. Phone calls typically last 20–30 minutes.

Follow up visits—The 6- and 12-month visits are identical to the baseline visit with the exception of consent form review (see Table 4). Participants are encouraged to reach out to the study manager or nurse coordinator with questions between the follow up visits; however, the study team does not initiate contact aside from visit scheduling. Participants receive \$50 and \$75 gift cards for their participation at respective 6- and 12-month visits.

Qualitative Interviews

A subset of men from both groups are purposively selected to participate in an exit qualitative interview completed telephonically with the Principal Investigator (PI). The interview focuses on understanding their decision-making processes regarding physical activity and nutrition. Selection for the qualitative interview is purposive to sample the range of experiences in both the intervention and attention control groups. Men are asked to describe their experience with ADT over the past year and their understanding of ADT and its effects. Further questions ask them to talk about facilitators and barriers to participation, how they have chosen foods over the past 12 months, what has influenced their choices, what types and amount of activity they have engaged in, and their rationale for engaging in those selected activities. We will analyze transcripts for categories within and across groups. This will allow us to understand if there are differences in decision-making between men in the intervention and attention control groups.

Planned Data Analysis

Analyses for Aim 1 will compare groups in terms of their change in metabolic indicators over time, using a mixed effects model for repeated measures, in which group (intervention versus attention control) is considered a fixed between-group factor. Each outcome indicator will be considered as a dependent variable in separate models. In these models, the group-by-time interaction will be examined to determine differences between groups over time. Additional contrasts will examine the shape of the pattern of change over time within each group, specific change from baseline to 6 months and baseline to 12 months within each group, and the difference between groups at each observation point. A similar approach will be used to test the hypothesis for Aim 2, with general HRQOL and disease-specific HRQOL as dependent variables.

Aims 3 and 4 will be met through qualitative analysis of interviews using grounded theory techniques. All interviews are audio recorded with the participant's permission. Recordings will be transcribed verbatim. The PI will read each transcript in its entirety and proceed with segment by segment coding to identify emergent codes. Subsequently, related codes will be clustered together and developed into categories describing processes used by the participants to make dietary and physical activity choices and their interpretation and implementation of the intervention. We will then describe categories in terms of properties and dimensions leading to identification of relationships between categories to develop the explanatory framework for activity/nutrition decision making in each group. We will explore categories for explanations of adherence and non-adherence with the intervention and for nuances that explain the quantitative findings. The explanatory frameworks will be used to contextualize interpretation of the outcome measures, taking into account participants' decision processes, contextual factors that influenced outcomes, perception of importance and relationship of nutrition and activity to HRQOL, well-being during ADT, and overall acceptability and benefit of the intervention.

Discussion

We have described our innovative protocol and synergistic approach to mitigating the various side effects of ADT. Though no study is without obstacles, we have found aspects of the trial to be quite beneficial for our patients. Specifically, our intervention is adaptable and based on the individual needs and preferences of each participant. The nurse coordinator is flexible in many aspects to accommodate the individual. For example, the nurse accommodates individual preferences to 1) communicate via telephone, email, postal mail, or text messaging to answer questions between calls 2) provide reminders of visits and calls and 3) make available extra hard copies of educational materials through the postal mail should they be requested. Furthermore, some participants prefer only a didactic approach to educational content delivery whereas others prefer to review the materials in advance, review the content on the call, and then have a conversation about their reactions to or questions about the material. Another strength of the intervention is that we provide participants with their exercise equipment. Our protocol does not require a gym membership or any extra equipment. Should the participant prefer a community or group setting, they can bring their resistance bands to a public place and complete the exercise component there. Additionally, the nurse provides ongoing reinforcement and praise of behavioral changes and encouragement when barriers to behavioral change are identified. Analysis of the qualitative interviews will give us more insight into the most valuable components of our protocol from the patient's perspective.

Although not unique to our study, recruitment has presented some challenges. Enrollment began at KUMC in January 2017 and will close to accrual in summer 2019. Multiple recruitment tactics have been employed but only a few have been successful. Our team has made efforts to utilize existing relationships and build new relationships with health providers and care systems within the area who could be of help with recruitment. Members of the study team have attended Prostate Network meetings within the metropolitan area to provide study awareness to potential participants and caregivers. However, all participants enrolled thus far have been referred from internal KUMC clinics.

We have met various roadblocks with outside facilities. In many cases, the PI and study manager met with nurse navigators from other clinics; although there was initial interest, other barriers presented themselves that made collaborations unsuccessful. For example, we were told by study nurses and coordinators that transportation to KUMC would be the main obstacle, noting that they had failed in their efforts to get their own patients to research visits at their 'home' hospital or clinic. Though the study has a built-in budget for transportation, the reluctance to participate in research appears to extend beyond transportation. We plan to explore reasons for this further.

Even though it has not hindered recruitment, scheduling has been another component to juggle. In working with an interdisciplinary team, there are many schedules to accommodate in addition to the space and staff availability at the Clinical Translational Science Unit. Although coordinating schedules might seem insignificant, it can be quite tricky. In addition, because we are looking for men who are within the first 3 months of initiating ADT, immediate referrals are imperative. At best, time from initial contact from the study team to the potential participant agreeing to participate takes weeks. Then, depending on schedules, it can take 6+ weeks before the baseline visit comes to fruition. Thus, flexibility and teamwork are a must, along with frequent and close communication.

To date, 38 participants have been enrolled, 20 participants have completed the study, and 6 participants have withdrawn consent or were lost to follow up. Some initial qualitative comments have indicated that men find the phone calls helpful in progressing their understanding of ADT and the importance of healthy behaviors. We will begin full analyses upon completion of data collection on the quantitative measures.

Conclusion

With a high prevalence of PC and increasing survival rates, it is necessary to maximize QOL and minimize side effects of treatment; our intervention aims to address both. Future efforts will be aimed at identifying components of this protocol which could be easily adapted for routine clinical use. This will allow us to reach a more diverse sample and aid in a more comprehensive care plan for men on ADT as it seems to be an unmet need at this time.

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Table 1.**Study Primary Outcome Measures**

Measure	Description
BMI	BMI is calculated as [weight (pounds)/height (inches) ²] × 703 (CDC, 2017). Categories to measure obesity are: underweight = <18.5, normal = 18.5 – 24.9, overweight = 25 – 29.9, obese = ≥ 30.
Waist-to-hip circumference	Waist circumference is collected with a measuring tape device by locating the upper hip bone and the top of the right iliac crest and wrapping around the body for measurement. Hip circumference is collected with a measuring tape device starting at the right hip and wrapping the tape measure around to the other hip for measurement (NHLBI Obesity Education Initiative Expert Panel on the Identification, Evaluation, and Treatment of Obesity in Adults (US), 1998).
Lipid levels	Total cholesterol, HDL, LDL, and triglycerides are measured using commercially available assay.
Blood glucose levels	Fasting blood glucose and HbA1c levels are measured using commercially available assays.
SF-12 v2	A short, self-report questionnaire to assess general HRQOL with physical (PCS) and mental component scores (MCS); $\alpha_{PCS} = 0.89$, $\alpha_{MCS} = 0.88$ (Bhandari, Kathe, Haye, & Payakachat, 2018).
EPIC-26	A disease-specific measure of HRQOL, assessing patient function and bother after prostate cancer treatment. Includes 4 domains: urinary, bowel, sexual, and hormonal function; $\alpha = 0.82$ in each domain (Wei, Dunn, Litwin, Sandler, & Sanda, 2000).

Note. BMI = body mass index; EPIC-26 = Expanded Prostate Cancer Index Composite Short Form; HbA1c = hemoglobin A1c; HDL = high-density lipoprotein; HRQOL = health-related quality of life; LDL = low-density lipoprotein; MCS = mental component score; PCS = physical component score; SF-12 v2 = Short Form 12 item version 2.

Table 2.**Description of Intervention Resistance and Aerobic Exercises**

Exercise	Description
Squat	Participants are instructed to hold both handles at shoulder height and stand on band with both feet hips width apart. Participants are then instructed to bend their legs and squat down as low as they can go without having pain or until their thighs are parallel to the floor. Participants then return to a standing position.
Reverse Lunge	Participants are instructed to hold both handles at shoulder height and stand on the middle of a band with one foot. Participants are then instructed to step back with the foot not on the band and lower your knee until the thigh of your front foot is parallel with the floor. Participants then return to a standing position.
Push up	Participants are instructed to lay on the floor and place their hands palms down on the floor about 20 inches apart. Participants are then instructed to push their entire body off the floor until their arms are almost straight keeping their back and legs straight, then return to the starting position.
Standing Overhead press	Participants are instructed to hold both handles at shoulder height and stand on band with both feet hips width apart. Participants are then instructed to press the handles overhead, extending the arms fully, then return to the starting position.
Stiff arm pulldown	Participants are instructed to secure the band at the top of the door (with door anchor) and stand 3 – 4 feet away from the door (facing door). Participants are instructed to stand straight holding the handles with their arms extending straight overhead. Participants then pull the handles down in front to the top of the thigh, keeping their arms straight, then returning to the starting position.
Wide pulldown	Participants are instructed to secure the band at the top of the door (with door anchor) and kneel 3 – 4 feet away from the door (facing door). Participants are instructed to hold the handles with their arms extending straight overhead. Participants then pull the handles back until their hands are by their chest and then return to the starting position.
Bent over row	Participants are instructed to stand on band with both feet hips width apart holding the handles at their side. Participants are then instructed to bend forward at their waist, slightly bending their knees and switching the handles to the opposite hand (crisscrossing the band). With palms facing each other, participants then pull the handles back until their hands are by their chest and then return to the starting position.
Single arm bent over row	Participants are instructed to stand on one end of a band and hold the handle in one hand while placing their opposite knee and hand on a bend. Participants are instructed to begin with their arm straight and then pull the handle back until their hand is by their chest, then return to the starting position.
Standing chest press	Participants are instructed to secure the band to the middle of a door (with door anchor) and stand 3 – 4 feet away from the door (facing away from door). Participants are instructed to stagger their stand and hold the handles at shoulder high with their elbows bent and hands by their chest. Participants then press the handles forward until their arms are fully extended, then return to the starting position.
Lying Hamstring curls	Participants are instructed to secure the band to the door with the door anchor at bottom of a door. Participants wrap ankle straps around both ankles and lay on the floor 3 – 4 feet away from the door. Participants are then instructed to bend both legs moving their heels towards their buttocks and then return to the starting position.
Bicep curls	Participants are instructed to hold both handles at shoulder height and stand on band with both feet hips width apart. Starting with their arms down and palms facing forwards, participants are then instructed to bend their arms at the elbow until their hands are at chest height. Participants then return to a starting position.
Plank	Participants are instructed to lay on the floor and place their hands palms down on the floor about 20 inches apart. Participants are then instructed to push their entire body off the floor until their arms are almost straight keeping their back and legs straight. Participants are instructed to hold this position for about 20–30 seconds.
Aerobic exercise: Walking, running, swimming, cycling	Participants are instructed to walk (or participate in other aerobic exercise) for 30 minutes on the days they do not perform the resistance exercises.

Note. Modifications to exercises can be made based on participant's ability.

Table 3.

Intervention Physical Activity Prescription

Resistance Bands				Aerobic Exercise			
Week	# days per week	Repetitions	Sets	Week	# days per week	Duration	Intensity
1 – 3	3	12 – 15	2 – 3	1 – 3	2 – 3	30 minutes	50 – 60% of maximum HR
4 – 6	3	8 – 12	3 – 4	4 – 6	2 – 3	30 minutes	60 – 65% of maximum HR
7 – 9	3	8	4 – 5	7 – 9	2 – 3	30 minutes	70 – 75% of maximum HR
10 – 12	3	6 – 8	5	10 – 12	2 – 3	30 minutes	75 – 80% of maximum HR

Note. HR = heart rate. Modifications to exercises can be made based on participant's ability and their progression through the intervention.

Table 4.

Data Collected at Baseline, 6 and 12 Months

Procedure	Baseline Visit	6 Month Visit	12 Month Visit
Informed consent	X		
Lipid and blood glucose levels	X	X	X
BP, HR, height, weight	X	X	X
Hip and waist circumference	X	X	X
Demographic questionnaire	X		
Medical history questionnaire	X	X	X
CES-D, IPAQ, SF-12 v2, EPIC-26	X	X	X
TIBI-CaP	X		
GXT testing	X [*]	X [*]	X [*]
1RM upper and lower body	X [*]	X [*]	X [*]
Physical activity prescription	X [*]		
24-hour dietary recall	X	X	X
Nutrition coaching	X [*]		
Physical activity and nutrition goal setting	X [*]		
Cell phone tutorial	X [*]		
Subject payment	X	X	X

* Intervention group only.

Note. BP = blood pressure; CES-D = Center for Epidemiologic Studies Depression Scale; EPIC-26 = Expanded Prostate Cancer Index Composite Short Form; GXT = treadmill graded exercise; HR = heart rate; IPAQ = International Physical Activity Questionnaire; RM = repetition maximum; SF-12 v2 = Short Form 12 item version 2; TIBI-CaP = Total Illness Burden Index for Prostate Cancer.