Perspectives on Exercise Prescriptions/Referrals and Patient Exercise Behavior Change: A Mixed Methods Study of Physicians and Exercise Professionals

PERSPECTIVES ON EXERCISE PRESCRIPTIONS/REFERRALS AND PATIENT EXERCISE BEHAVIOR CHANGE: A MIXED METHODS STUDY OF PHYSICIANS AND EXERCISE PROFESSIONALS

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Abstract

Americans are sitting more and moving less, with serious repercussions for health. Only 23% of Americans meet the recommended guidelines for both aerobic and strength training activities. The 2018 Physical Activity Guidelines Advisory Committee Scientific Report identifies the clinical setting as a scalable opportunity to influence population-level physical activity if effective approaches can be implemented, and specifically mentions exercise prescriptions/referrals. Exercise prescriptions are written prescriptions from clinicians involving specific physical activity recommendations, which may include referrals to exercise facilities and professionals.

Using a mixed methods explanatory sequential design, data was collected and analyzed from quantitative surveys completed by 50 physicians and 12 exercise professionals, as well as semi-structured qualitative interviews with 7 physicians and 5 exercise professionals. The study site was a New England healthcare organization and its hospital-affiliated health & fitness center.

This doctoral project identified evidence-based physician practices around exercise prescriptions/referrals to be writing prescriptions, identifying risk factors, tailoring prescriptions, refilling prescriptions, referring to exercise facilities/professionals, and using motivational interviewing. It concluded that limited time, concerns about costs to patients, insufficient training and confidence in providing appropriate prescriptions are barriers to physicians writing exercise

prescriptions/referrals. It synthesized ten steps—focused around communication and collaboration, education and training, and tools and technology (e.g., electronic medical record systems)—that the study site and other healthcare organizations can take to address the barriers.

The results demonstrated marked differences in physicians' practices and comfort in referring based on facility type, with a higher mean comfort level referring to hospital-based versus community-based exercise facilities and professionals. A roadmap was developed for health & fitness centers—ten steps toward being facilities that physicians would trust to take good care of patients and help them achieve their health & fitness goals.

Applying a social ecological lens to exercise prescriptions/referrals, this doctoral project examines the multilevel factors influencing individuals' exercise behavior. It calls for more research on the impact of exercise prescriptions/referrals on patient exercise behavior and health outcomes. It raises the potential of framing exercise prescriptions/referrals within social prescribing and social determinants of health movements, as part of a larger discussion about connecting healthcare to community-based resources to improve population health.

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I. INTRODUCTION

1. Public Health Problem

Americans are sitting more and moving less, with serious repercussions for health. Between 2007 and 2016, time spent on sedentary behavior among U.S. adults significantly increased from 5.7 hours per day to 6.4 hours per day (Du et al., 2019). Headlines warn that "sitting is the new smoking" and that the life expectancies of future generations will be "cut short by obesity" (Belluck, 2005, para. 1; Gerstacker, 2014, para. 3). It is a rare presentation on obesity that begins without the time lapse of obesity prevalence 1985-2018, with light blue (indicating less than 10% of the adult population with obesity) bleeding to dark red (indicating 35% or more of the adult population with obesity) on the U.S. map (see Figure 1)

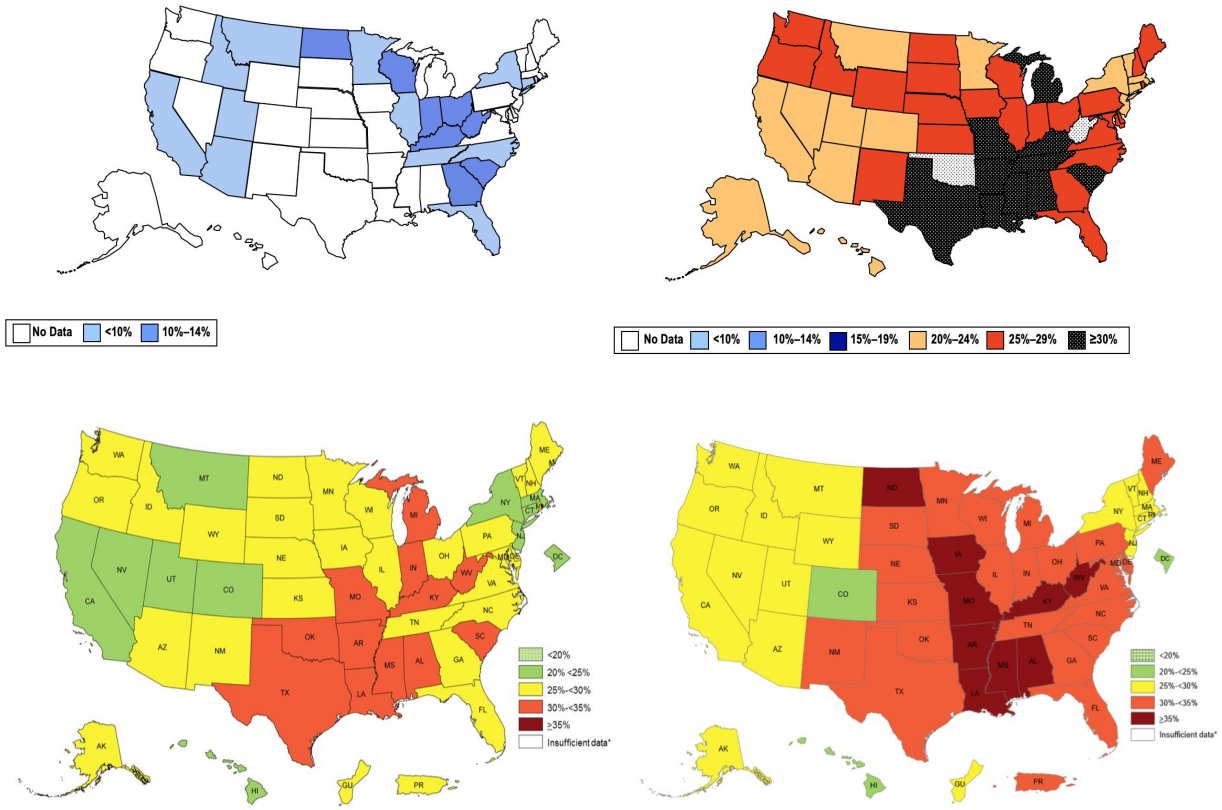

Figure 1. Prevalence of Self-Reported Obesity Among U.S. Adults, 1985 (top left) to 2010 (top right), and 2011 (bottom left) to 2018 (bottom right). Reprinted from "Adult Obesity Prevalence Maps" (CDC/NCCDPHP, 2019).

Several national initiatives over the past three decades attempted to educate people about the health benefits of physical activity in preventing and managing chronic disease, and to help people understand the amount of physical activity they need to reduce disease risk and improve health. The first-ever Surgeon General's report on physical activity and health linked daily moderate physical activity with improved health and quality of life (U.S. Department of Health and Human Services [HHS], 1996). First released in 2008 and updated in 2018, the Physical Activity Guidelines for Americans recommend that adults get at least 150 minutes of moderate or 75 minutes of vigorous exercise each week, in addition to muscle-strengthening activities at least twice a week (HHS, 2018b; President's Council on Sports Fitness & Nutrition [PCSFN], 2019). The 2018 Physical Activity Guidelines Advisory Committee Scientific Report summarized the scientific evidence on physical activity for the general population, as well as for specific populations, finding strong evidence that regular moderate-to-vigorous physical activity is associated with preventing or minimizing excessive weight gain, maintaining weight within a healthy range, and preventing obesity (HHS, 2018a). In addition, regular physical activity is also associated with a lower risk of all-cause mortality, lower cardiovascular disease incidence and mortality rates, lower incidence of hypertension and lower incidence of type 2 diabetes, as well as reducing the risk of bladder, breast, colon, endometrium, esophagus, kidney, stomach and lung cancers (HHS, 2018a).

Physical activity positively impacts length of life and quality of life; yet despite the known health benefits, too few people are physically active. According to a Centers for Disease Control and Prevention (CDC) National Center for Health Statistics (NCHS) report released in June 2018, only 23% of Americans meet the guidelines for both aerobic and strength training activities through leisure-time physical activity, an additional 32% meet the guidelines for either aerobic or strength training activities, and 45% do not meet the guidelines for either aerobic or

strength training activities (Blackwell & Clarke, 2018). More than 81 million Americans aged six and older do no leisure-time physical activity (Physical Activity Council, 2019). In January 2020, the CDC launched Active People, Healthy Nation, a new initiative to help 27 million Americans become more physically active by 2027, and published physical inactivity maps by race and ethnicity for the very first time (see Figure 2).

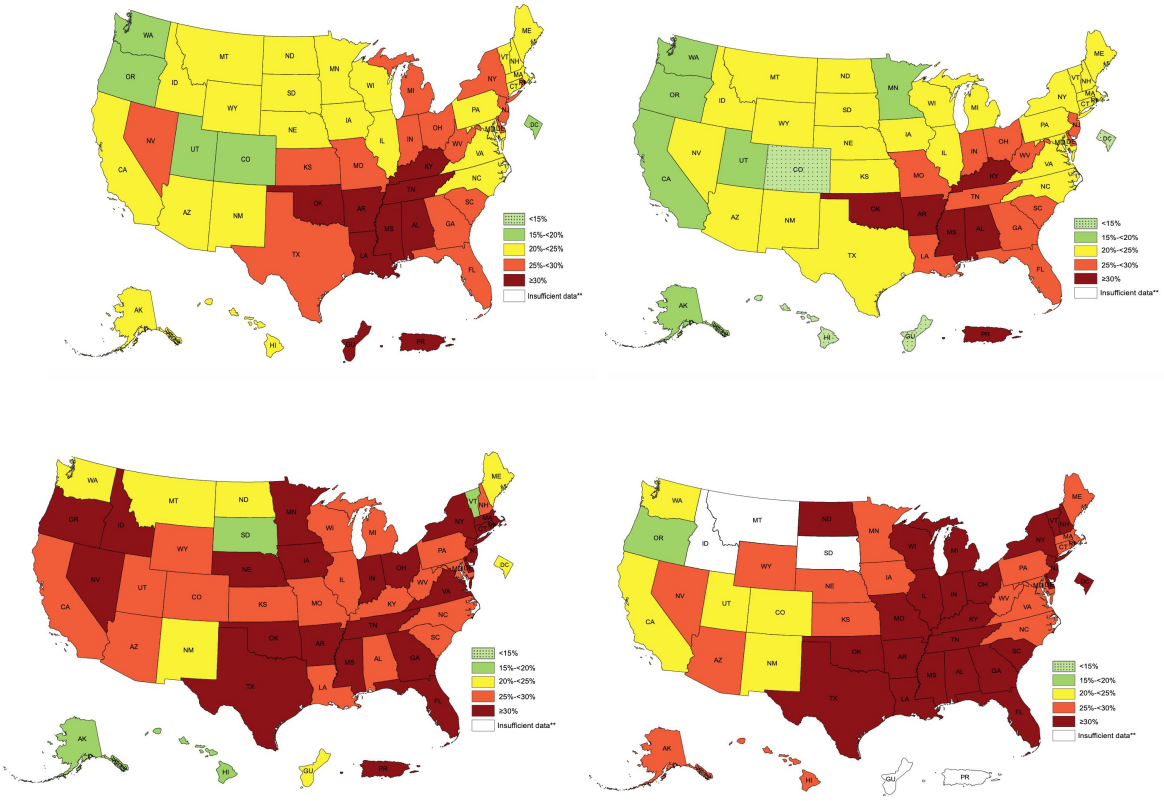

Figure 2. Prevalence of Self-Reported Physical Inactivity Among U.S. Adults, 2015-2018, Overall (top left), Non-Hispanic White Adults (top right), Hispanic Adults (bottom left), Non-Hispanic Black Adults (bottom right). Reprinted from “Adult Physical Inactivity Prevalence Maps by Race/Ethnicity” (CDC/NCCDPHP, 2020).

2. Interventions in Clinical Settings

Getting more people more physically active may require reaching them in a variety of settings using a variety of strategies. The 2018 Physical Activity Guidelines Advisory Committee Scientific Report identifies the clinical setting—specifically, the primary care setting—as an "appealing venue" for offering physical activity counseling or referral (HHS, 2018a, p. F11-40). It is most likely appealing for a number of reasons, including: regular contact—85.1% of Americans report having contact with a physician or other healthcare professional in the past year; and, trust—Americans rate the honesty and ethical standards of nurses, followed second by physicians, higher than any other type of professional (Brenan, 2018; CDC/NCHS, 2017).

Therefore, the 2018 Physical Activity Guidelines Advisory Committee Scientific Report homes in on the potential of the clinical setting as a "scalable opportunity" to influence population-level physical activity "if effective approaches can be implemented" (HHS, 2018a, p. F11-40). It states that brief interventions in the clinical setting may not be sufficient, with "limited efficacy" for significantly increasing physical activity (HHS, 2018a, p. F11-40). That said, it recognizes that intervention efficacy may be enhanced by providing more standardized interventions delivered across health systems. It also recognizes that intervention efficacy may be enhanced by using more robust strategies, such as motivational interviewing supplemented with written "prescriptions involving specific physical activity recommendations." (HHS, 2018a, p. F11-40)

This doctoral project aims to help realize the potential of the clinical setting as a scalable opportunity to influence population-level physical activity. It uses a mixed methods approach—a quantitative survey sent to 259 physicians at a New England healthcare organization and 19

exercise professionals at a health & fitness center affiliated with that New England healthcare organization, as well as semi-structured qualitative interviews with physicians and exercise professionals who opted in through the surveys. It seeks to understand how much physicians write exercise prescriptions, why physicians do (or do not) write exercise prescriptions, and what physicians and exercise professionals know about patient adherence to exercise prescriptions. Reviewing the literature and compiling survey and interview results on evidence-based physician practices around exercise prescriptions will inform effective approaches to physicians writing exercise prescriptions to change patient exercise behavior.

3. Connecting the Clinical and Community Settings

Getting more people more physically active may also require referring them to a person, such as an exercise professional, or a place, such as a health & fitness center, that can help them become physically active. There are many different models for physicians writing exercise prescriptions/referrals. Physicians can prescribe exercise as part of a national program or on an individual or practice basis. They can provide personalized, detailed exercise dosage information or refer patients into a supervised, semi-supervised or unsupervised physical activity program. Physicians can refer patients to a hospital- or clinic-affiliated health & fitness center, a community-based health & fitness center not affiliated with a hospital or clinic, an independent exercise professional, or a home setting.

However, not enough U.S. physicians write exercise prescriptions/referrals. According to the CDC/NCHS, in 2010, only 32.4% of adults who had seen a physician in the past 12 months had been advised to exercise (Barnes & Schoenborn, 2012). Moreover, a 2012 survey of sports medicine physicians revealed that while 66% talk to their patients about exercise, significantly fewer, 26%, write exercise prescriptions for their patients. (Pojednic et al., 2017). It

also revealed that a majority of physicians are disinclined to refer their patients to a health & fitness center or an exercise professional due to concerns about cost and convenience (Pojednic, Bantham, Arnstein, Kennedy, & Phillips, 2018).

This doctoral project aims to help bridge the gap between healthcare and health & fitness centers. It seeks to understand where physicians refer patients and where patients fill exercise prescriptions/referrals, how physicians and exercise professionals collaborate to help patients fill exercise prescriptions/referrals, and why physicians do (or do not) refer patients to health & fitness centers and exercise professionals. Reviewing the literature and compiling survey and interview results on the characteristics of health & fitness centers and exercise professionals that physicians would trust to refer their patients will help health & fitness centers and exercise professionals become those trusted community resources.

4. Doctoral Thesis Structure

This doctoral project first defines exercise prescriptions/referrals and contextualizes them geographically and historically, examining model exercise prescription/referral programs in other countries which can inform a U.S. setting. It then explores four research questions:

1) What are evidence-based physician practices around exercise prescriptions/referrals?
2) What are barriers and facilitators to physicians writing exercise prescriptions/referrals?
3) What are characteristics of exercise professionals and health & fitness centers that physicians would trust to refer their patients?
4) What is the impact of physician exercise prescriptions/referrals on patient exercise behavior?

The results of a literature review are compiled in the Analytical Platform section. The Analytical Platform section also contains a methodology and a framework for change based on the social ecological model. The results of the surveys and interviews are compiled and analyzed in the Results and Discussion sections. The Conclusion addresses broader systemic and policy changes needed to facilitate physicians writing exercise prescriptions/referrals to change patient exercise behavior.

II. ANALYTICAL PLATFORM

1. Problem Statement

Insufficient physical activity is a key modifiable risk factor for non-communicable diseases (NCDs) and the fourth leading risk factor for death worldwide (World Health Organization [WHO], n.d.). Globally, one in four adults is insufficiently physically active (WHO, 2018b). In the United States, not enough Americans—only 23%—are meeting physical activity guidelines for both aerobic and strength training activities (Blackwell & Clarke, 2018).

The WHO Global Action Plan on Physical Activity 2018-2030 spotlights physical activity counseling/brief advice in clinical settings, and referrals to community resources, as an "important and effective component of a population-based response to increasing physical activity and reducing sedentary behavior" (WHO, 2018a, p. 25). The 2018 Physical Activity Guidelines Advisory Committee Scientific Report also focuses on the potential of the clinical setting as a "scalable opportunity" to influence population-level physical activity, but finds brief interventions in the clinical setting (e.g., brief advice) to be insufficient, with "limited efficacy" for significantly increasing physical activity (HHS, 2018a, p. F11-40). More robust strategies, such as motivational interviewing supplemented with exercise prescriptions, are specifically mentioned as means to enhance intervention efficacy (HHS, 2018a).

2. Project Goals

This doctoral project seeks to understand evidence-based physician practices around exercise prescriptions/referrals that will inform effective approaches to influence population-level physical activity. Considering that too few U.S. physicians are counseling their patients on physical activity, and a fraction of those actually write exercise prescriptions/referrals, this

doctoral project examines barriers and facilitators to physicians writing exercise prescriptions/referrals. In addition, since too few U.S. physicians are referring patients to places/people that can help them fill exercise prescriptions, this doctoral project aims to understand the characteristics of health & fitness centers/exercise professionals that physicians would trust to refer their patients. Finally, because too few U.S. physicians know whether their patients follow through on exercise prescriptions/referrals, this doctoral project explores the impact of exercise prescriptions/referrals on patient exercise behavior.

3. Project Description

This doctoral project consists of three parts. The first part is a literature review to contextualize exercise prescriptions/referrals geographically and historically, including model exercise prescription/referral programs, evidence-based physician practices, physician barriers and facilitators, referrals to exercise facilities/professionals, and patient exercise behavior change. The second part is a mixed methods research study of an exercise referral network at a New England healthcare organization, researching the perspectives of physicians and exercise professionals on exercise prescriptions/referrals and patient exercise behavior change. The third part is recommendations for how the healthcare organization can address barriers to physicians writing exercise prescriptions/referrals, as well as recommendations for how health & fitness centers and exercise professionals can become community resources that physicians would trust to refer their patients.

4. Literature Review Methodology

4.1 Search Strategy

The initial search was conducted with the Harvard University Countway Library of Medicine staff and used six databases for biomedical literature, including the National Library of Medicine's MEDLINE/PubMed, Elsevier's Embase, Web of Science, CINAHL, PsycInfo, and Cochrane Library. Search terms varied by database, but generally included "exercise" and "prescription" and "outcome." Two supplemental searches were also conducted. The first supplemental search was conducted using Google Scholar and the search terms "exercise prescription," "exercise referral," and "physical activity prescription." The second supplemental search was conducted by reviewing the reference lists in the systematic reviews and articles yielded in the initial search.

4.2 Inclusion Criteria

Articles were considered eligible if they met all of the following inclusion criteria. First, exercise prescriptions/referrals were made by a recognized prescriber in a primary care or specialty care setting. Second, patients receiving exercise prescriptions/referrals were recruited exclusively from a healthcare setting, as opposed to community-based recruitment. Third, patients were deemed to be at-risk if they had overweight/obesity, diabetes, cardiovascular disease, musculoskeletal problems, or cancer. Fourth, patients were between 18 and 65 years of age. Fifth, articles were published in peer-reviewed journals in English after 2000.

4.3 Exclusion Criteria

Articles were excluded if the exercise prescriptions/referrals were made by physical therapists. They were also excluded if physical therapists were the sole professionals who helped the patients fill the exercise prescriptions/referrals. Finally, articles were excluded if they were study protocols.

4.4 Results

The initial search yielded 1,920 articles. The two supplemental searches yielded 142 additional articles. After deduplication, 2,038 articles were loaded into Covidence and Faculty of 1000 Workspace for review. On the basis of title and abstract screening, 1,819 articles were removed. This left 219 articles for full text screening; of these, 92 were excluded based on wrong interventions, outcomes or patient population. A total of 127 articles were included in the final analysis (see Figure 3).

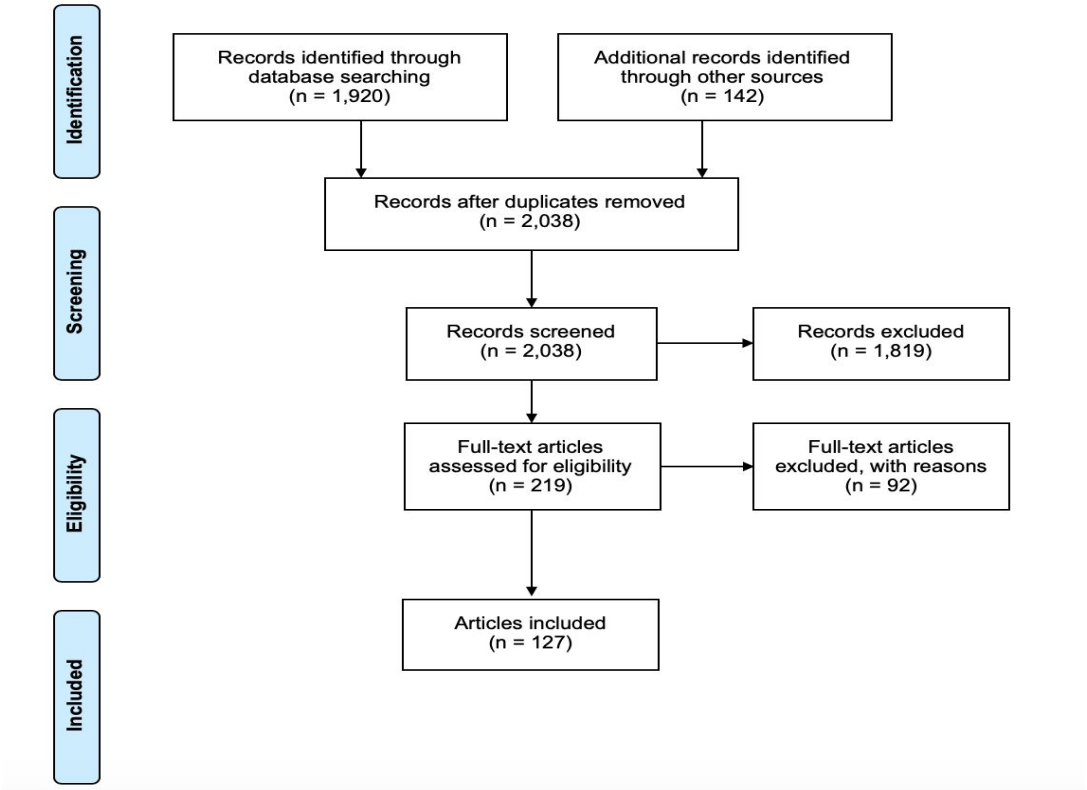

Figure 3. Literature Review Search Strategy Flow Chart. Adapted from "Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement" (Moher, Liberati, Tetzlaff, & Altman, 2009).

5. Model Exercise Prescription/Referral Programs

What are model exercise prescription/referral programs in other countries which can inform a U.S. setting?

5.1 Exercise Prescription/Referral Program Definition

Exercise prescription/referral programs are physical activity promotion programs initiated in the clinical setting and delivered in the clinical or community setting. Their goal is to increase physical activity, especially among at-risk population groups, for the prevention and management of chronic disease. Providers—usually primary care physicians and

nurses—prescribe exercise to patients or refer patients to third parties (e.g., community-based exercise facilities/professionals) who prescribe and supervise exercise programs (Leemrijse, De Bakker, Ooms, & Veenhof, 2015). Depending on the country, these programs are called "Exercise Referral Schemes (ERS)," "Physical Activity Referral Schemes (PARS)," "Exercise on Prescription (EoP)," "Physical Activity on Prescription (PAP)," "Physical Activity Prescription Programs (PAPP)", "Green Prescriptions (GRx)" or "Exercise is Medicine®" (Arsenijevic & Groot, 2017). Although the terms are often used interchangeably, they can mean very different things, ranging from supervised programs to semi-supervised programs to unsupervised exercise, in a clinic-based, community-based or home-based setting.

5.2 Exercise Prescription/Referral Program History

The first exercise prescription/referral program was launched in the United Kingdom in the early 1990s (Gidlow et al., 2007). By 2005, 89% of primary care organizations ran an ERS (Tobi, Estacio, Yu, Renton, & Foster, 2012) and by 2006, there were 600 ERS (Pavey et al., 2011). According to the National Institute for Health and Clinical Excellence (NICE), an ERS must include a primary care or allied health professional's assessment to determine that someone is physically inactive, a primary care or allied health professional's referral to a physical activity specialist or service, a physical activity specialist's assessment to determine a specific physical activity program, and an opportunity to participate in a physical activity program (NICE, 2014). NICE also recommended the implementation of a system—the National Referral Database—to collate local data on ERS to build the evidence base and inform best practice (Steele et al., 2019).

GRx, a nationwide exercise prescription program, was initiated by Sport and Recreation New Zealand (SPARC) in 1998 and transferred to the New Zealand Ministry of Health in 2009

(Sinclair & Hamlin, 2007; New Zealand Ministry of Health, 2017). GRx is administered in the same way as a pharmaceutical treatment, with a prescription (Patel, Schofield, Kolt, & Keogh, 2011). General Practitioners (GPs) or practice nurses issue verbal advice and exercise prescriptions—either written or issued electronically— and refer patients to trained exercise professionals from regional sports trusts; between 2013 and 2014, 40,000 GRx were issued (Elliot & Hamlin, 2018). GPs write down type, intensity and frequency of exercise on the prescription (Patel, Keogh, Kolt, & Schofield, 2013). A GRx support team is available to provide ongoing support (e.g., goal setting, motivation, activity options) through monthly telephone calls for 3-4 months, face-to-face meetings for 3-4 months, or group support in a community setting for 3-6 months (New Zealand Government and Ministry of Health, 2016; New Zealand Ministry of Health, 2017). GRx has been expanded to include alternatives, such as a pedometer step-based "Healthy Steps GRx," as opposed to the standard time-based GRx, or an "enhanced GRx" with face-to-face follow-up at 6 months with a primary care nurse and 9 months of telephone support from an exercise specialist (Elley et al., 2011; Kolt et al., 2012).

In 2001, the PAP program was introduced by the Swedish National Institute of Public Health as a part of the national "Sweden on the Move" campaign and is now used by all Swedish county councils providing healthcare in Sweden (Andersen, Holmberg, Lendahls, Nilsen, & Kristenson, 2018). All licensed healthcare professionals, including physicians, nurses and physiotherapists, may prescribe exercise through the PAP program (Onerup et al., 2019). The number of annual prescriptions increased from 17,000 in 2007 to 49,000 in 2010, although variation among county councils remains (Kallings, 2012). There are five core elements to the program: patient-centered counseling; written prescription of individualized physical activity; use of the textbook *FYSS* (*Physical Activity in the Prevention and Treatment of Disease*) for evidence-based prescriptions; follow-up assessments; and collaboration with community

physical activity organizations (Olsson et al., 2015). The PAP program ranges from facility-based activities at local PAP providers (e.g., gyms, sports clubs, sports associations) with PAP-educated personnel (e.g., personal trainers, club members) to individualized exercise prescriptions for home-based activities (Raustorp & Sundberg, 2014).

In 2007, the American Medical Association (AMA) and the American College of Sports Medicine (ACSM) launched Exercise is Medicine® to increase the number of physicians writing exercise prescriptions (Sallis, 2015). Started in the United States, it has a presence in 40 countries working with healthcare, medical, public health, and fitness organizations to establish national Exercise is Medicine® centers (ACSM, 2019b). Exercise is Medicine® encourages healthcare providers, particularly primary care physicians, to assess and record physical activity as a vital sign, write exercise prescriptions, and/or refer patients to evidence-based exercise programs and qualified exercise professionals (ACSM, 2019c). The Exercise is Medicine® Solution integrates clinical healthcare provider services with community evidence-based exercise programs (Lobelo, Steinacker, Duperly, & Hutber, 2014). It comprises three modules—clinical, community, active health technology—and five steps—physical activity assessment, physical activity prescription/behavioral counseling, physical activity self-management or referral, development of a community-based physical activity referral network, and clinical-community integration (Lobelo, Stoutenberg, & Hutber, 2014).

In addition to New Zealand, Sweden, the United Kingdom and the United States, other countries with exercise prescription/referral programs include Belgium, Denmark, Finland, Germany, the Netherlands, Norway, Portugal, and Spain (Arsenijevic & Groot, 2017). The programs vary in structure country-to-country. The Finnish model is interesting because exercise counseling uses one of the tools in the Exercise is Medicine® Solution, the 5A's framework—Assessment of physical activity habits, Advice on physical activity benefits,

Agreement on physical activity goals, Assistance with physical activity barriers, and Arrangements for physical activity logs; it also includes a referral to exercise professionals (Aittasalo, Miilunpalo, Kukkonen-Harjula, & Pasanen, 2006). The Dutch model is notable because it is an EoP program implemented at the local level and targeted to reach lower socio-economic groups and ethnic minority populations (Gademan, Deutekom, Hosper, & Stronks, 2012; Leemrijse et al., 2015).

6. Evidence-based Physician Practices

What are evidence-based physician practices around exercise prescriptions/referrals?

6.1 Writing Prescriptions

More physicians provide verbal advice about physical activity than written exercise prescriptions. Study after study, across countries, demonstrate the marked differential in the percentage of physicians using verbal counseling to promote physical activity versus providing written exercise prescriptions: 70% versus only 16% of primary care physicians in Canada (Petrella, Lattanzio, & Overend, 2007); 33% versus only 6% of primary care physicians in Mexico (Galaviz et al., 2015); and 66% versus only 26% of sports medicine physicians belonging to ACSM and the Institute of Lifestyle Medicine (ILM) (Pojednic et al., 2017). Physicians note a “double standard” in talking about physical activity but writing prescriptions for drugs (Persson, Brorsson, Hansson, Troein, & Strandberg, 2013, p. 4).

Yet, written exercise prescriptions have significant additional impact on patient exercise behavior. A meta-analysis of minutes of total physical activity per week at the 6–12 month follow-up showed an increase of 55.10 minutes (95% CI 18.47 to 91.73 minutes) for patients receiving written exercise prescriptions in the ERS groups compared with patients receiving advice only in the control groups (Campbell et al., 2015). There was a two-fold increase

(aOR=1.93; 95% CI, 1.19-3.15) in physical activity at 12-month follow-up in patients living in 12 rural communities in three states in the United States who received a prescription/plan from their physician, versus advice alone (Weidinger et al. 2008). In a study of primary care physicians randomized to provide physical activity advice and written exercise prescriptions or physical activity advice alone, intervention patients increased physical activity more than controls at 6-month follow-up (adjusted difference 18 min/wk [95% confidence interval, 6-31 min/wk]) (Grandes et al., 2009). Patients randomized to a GRx group with written exercise prescription and verbal advice significantly increased self-reported physical activity levels over a 6-week period, more than the verbal advice alone group (Swinburn, Walter, Arroll, Tilyard, & Russell, 1998).

Written prescriptions carry weight, and exercise prescriptions intentionally resemble medication prescriptions in look and language. The layout of the prescription uses a standardized prescription form (Leijon, Bendtsen, Nilsen, Festin, & Ståhle, 2009), and was developed to resemble medication prescriptions as a way to "enhance [its] significance" (Persson et al., 2013, p. 2). Patients receiving a written exercise prescription through a PAP program take it more seriously for carrying out the activity than merely talking about physical activity without a prescription: "it's just like medicine, the doctor prescribes a pill a day, instead the doctor prescribed water exercise once a week and then you have to go" (Andersen, Lendahls, Holmberg, & Nilsen, 2019, p. 5). A written exercise prescription elevates physical activity advice from a recommendation to an "order" (Phillips & Kennedy, 2012, p. 819).

6.2 Identifying Risk Factors/Conditions

There is a difference between exercise prescriptions for primary prevention (i.e., physical activity promotion for all patients) and exercise prescriptions for secondary prevention (i.e.,

physical activity advice delivered as part of a treatment regimen to patients with known risk factors/conditions) (Marshall, Booth, & Bauman, 2005). The literature reveals that GRx was applied as a primary prevention strategy for weight management purposes more than any other condition (Patel, Schofield, Kolt, & Keogh, 2011). In contrast, PAP was not viewed as a primary prevention strategy; rather, it was applied as a secondary prevention strategy by prescribing physicians and nurses to patients with high morbidity (Andersen et al., 2018). Similarly, patients referred to EoP programs by primary healthcare professionals were prescribed exercise for secondary rather than primary prevention (Horne, Skelton, Speed, & Todd, 2010). There may be a missed opportunity for physicians to prescribe exercise as both a primary and a secondary prevention strategy (Horne et al., 2010).

6.3 Tailoring Prescriptions

The literature reports that physicians are more likely to give general advice than specific advice. Although 95.5% of GPs in Copenhagen, Denmark reported giving advice on physical activity at least weekly, only 80% gave advice on type, 70% gave advice on duration and frequency, and 60% gave advice on intensity of exercise (Jørgensen, Nordentoft, & Krogh, 2012). There are calls for physicians to apply a similar degree of precision to exercise prescriptions as dosages and frequencies in medication prescriptions (Oberg, 2007; Phillips & Kennedy, 2012), and to tailor exercise prescriptions to specific patient needs in terms of Frequency, Intensity, Timing Type, Volume and Progression—or the FITT-VP principle (e.g., walking 5 days per week at moderate-intensity for 30 minutes per day for a total of 150 minutes per week, progressing up to 300 minutes per week as tolerated) (Zaleski et al., 2016). Exercise is Medicine® envisions the provision of a complex, customized exercise prescription as the next

step after the provision of a simple exercise prescription with activity type, number of minutes per day and total minutes per week (Cowan, 2016)

Individualized, specific prescriptions may be facilitators to patients filling and adhering to written exercise prescriptions. Almost half of the GPs (49%) prescribing exercise as part of an ERS thought that giving a specific and directed recommendation is more effective to motivate patients to start with physical activity, compared to open-ended advice (Leemrijse et al., 2015). Predictors of long-term exercise adherence varied with different forms of exercise in sedentary older women randomized to an exercise prescription with 2-year follow-up, and individually tailored exercise prescriptions may improve adherence (Findorff, Wyman, & Gross, 2009). Research indicating that exercise prescriptions increase population-level physical activity levels supports the finding that written exercise plans that specify the frequency, intensity, duration, and progression of exercise over time are more effective than minimal advice (Grandes et al., 2009). It also suggests an opportunity to develop physician training programs to improve provision of best practice around written, specific advice (Petrella et al., 2007).

6.4 Refilling Prescriptions

There is a process for refilling exercise prescriptions incorporated into some exercise prescription/referral programs, including GRx. Once a patient's progress is reported back to the referring physician, the physician can either discharge the patient "if no further benefit can be gained from GRx" or issue another GRx if the patient is not yet active, defined as doing at least 30 minutes of moderate physical activity per day on most if not all days of the week (New Zealand Government and Ministry of Health, 2016).

Prescription refills and booster programs (e.g., reminders via telephone, mail, in-person meetings, workshops) may be additional facilitators for patients filling and adhering to written

exercise prescriptions. When GPs were randomized to provide physical activity advice and written exercise prescriptions, with repeat prescriptions in one intervention subgroup, a significant difference in the proportion of patients achieving minimum physical activity recommendations was maintained until 24-month follow-up in the subgroup receiving a repeat prescription (adjusted difference 10.2%, 95% CI 1.5% to 19.4%) (Grandes et al., 2011). This was not the case for patients receiving a single prescription, and suggests that incorporating repeated interventions, like prescription refills, might enhance the long-term effectiveness of physician exercise advice (Grandes et al., 2011).

6.5 Referring to Exercise Facilities/Professionals

Physicians can refer their patients to exercise facilities and professionals to help patients change exercise behavior. About half (54%) of Dutch GPs referred patients to local fitness centers through an ERS program, and more than a third (37%) referred patients to local sports clubs (Leemrijse et al., 2015). In 2001, only 10.9% of Canadian primary care physicians referred patients to exercise professionals for assessment and exercise prescription (Petrella et al., 2007), but in 2017, referrals to exercise professionals was the most cited resource that physicians use to assist them in patient exercise counseling (Fowles, O'Brien, Solmundson, Oh, & Shields, 2018).

Exercise facilities and professionals can be an important part of an integrated team approach to the design and delivery of exercise prescriptions/referrals. In GRx, the physician's office faxes a copy of the exercise prescription/referral to a regional sports trust or a local leisure center to facilitate follow-up by an exercise professional, which includes goal setting, activity choice and identifying solutions for overcoming barriers (Elley, Kerse, Arroll, & Robinson, 2003). Australian accredited exercise physiologists work with physicians on interdisciplinary teams as

specialists in exercise prescriptions for at-risk patients; they are “essential but as yet underutilized” players in chronic disease prevention and management (Soan, Street, Brownie, & Hills, 2014, p. 65). Patients found it “inconceivable” to follow through on a referral to a gym through the PAP program without personalized support from personal trainers in demonstrating equipment and putting together an exercise program (Andersen et al., 2019, p.6). GPs prescribing exercise as part of a PAP program see shared responsibility among a team of health and exercise professionals as necessary for patient motivation to change exercise behavior (Persson et al., 2013).

Referral to community-based exercise facilities and professionals outside the healthcare setting could help facilitate a change in exercise behavior by integrating exercise into daily life (Leemrijse, et al., 2015) and providing prolonged and specialized advice, support and encouragement from exercise professionals (Patel et al., 2011). The effect of referral by GPs to coaching by exercise physiologists—a 70 minutes per week average increase in sedentary patients’ physical activity levels—persisted nine months after coaching concluded (Ewald et al., 2018). Among patients who were randomized to a 10-week program of supervised exercise classes at a local leisure center and an advice-only group, the net increase in the proportion achieving at least 150 minutes per week of moderate activity was 13.8% for the intervention group versus 7.5% in the control group at the 6-month follow-up (Isaacs et al., 2007). Among patients who did not adhere to exercise prescriptions through a PARS, those prescribed home-based activities were more likely to cite “low motivation” as a reason for non-adherence than those referred to facility-based activities (Leijon, Faskunger, Bendtsen, Festin, & Nilsen, 2011, p. 237).

6.6 Using Motivational Interviewing

The 2018 Physical Activity Guidelines Advisory Committee Scientific Report identifies exercise prescriptions in combination with motivational interviewing as a more robust strategy to enhance the efficacy of physical activity interventions in the clinical setting (HHS, 2018a). Motivational interviewing is defined as a "directive, client-centered counseling style for eliciting behavior change by helping clients explore and resolve ambivalence" (Rollnick & Miller, 1995, p. 107). It has evolved from its first use in alcoholism treatment to use in the treatment of a wide range of lifestyle diseases. Motivational interviewing mobilizes the patient's intrinsic values and goals to stimulate behavior change; in a scientific setting, it effectively helps clients change their behavior and outperforms traditional advice giving in approximately 80% of studies (Rubak, Sandbæk, Lauritzen, & Christensen, 2005).

Motivational interviewing is an important component of many exercise prescription/referral programs, employed by both providers prescribing exercise to patients as well as exercise professionals to which patients are referred. GPs prescribing exercise as part of a PAP program see motivational interviewing as an "art form" that requires not only training but also a great deal of practice to master (Persson et al., 2013, p. 4). As part of GRx, primary care physicians receive four hours of training on motivational interviewing techniques, and exercise specialists who provide telephone support also use motivational interviewing techniques (Elley et al., 2003).

Motivational interviewing can be a facilitator to patient adherence to exercise prescriptions/referrals and exercise behavior change. In combination with exercise prescriptions/referrals through a PAP program, motivational interviewing significantly increased leisure exercise time from less than 60 minutes per week at baseline to a mean physical activity

level of 300 (±165) minutes per week at 15 months follow-up in a pilot study of hypertensive patients (Sjöling, Lundberg, Englund, Westman, & Jong, 2011). Patients who were randomized to receive three sessions of telephone-delivered motivational counseling from behavioral health specialists after referral from their physicians in a U.S. primary care clinic had significantly higher levels of self-reported exercise at the 6-month follow-up (Green et al., 2002).

7. Barriers and Facilitators

What are barriers and facilitators to physicians writing exercise prescriptions/referrals?

7.1 Time

Lack of time is a barrier to physicians counseling patients on physical activity. In fact, lack of time was the most common barrier to physical activity counseling cited by physicians in a systematic review of nineteen studies (Hébert, Caughy, & Shuval, 2012). It was the physical activity counseling barrier rated most important by family physicians in Canada, with 65.7% rating it important to extremely important (Kennedy & Meeuwisse, 2003). Physicians would need 7.4 hours per working day to provide preventive services recommended by the United States Preventive Services Task Force, including physical activity counseling, to an average patient panel (Yarnall, Pollak, Østbye, Krause, & Michener, 2003).

Even if physicians are able to make the time to counsel patients on physical activity, lack of time serves as a barrier to writing exercise prescriptions/referrals. Physicians are less likely to provide tailored exercise prescriptions than to counsel on physical activity, and this can be attributed to a lack of time, as well as a lack of understanding of physiological and metabolic responses to exercise, lack of understanding of readiness to change behaviors, and lack of training in lifestyle interventions (Soan et al., 2014). A majority of GPs writing GRxs identified

time constraints as the most salient barrier for them; they tried to address this time barrier by having their practice nurse also write GRxs and by delegating activity choice to exercise professionals (Patel et al., 2011). Specialty physicians also cite lack of time as a barrier to prescribing exercise: they are less likely to prescribe exercise to colorectal cancer survivors than adults without cancer (16% versus 26.9% recommendation rate) due in part to competing demands on their time of addressing treatment complications and monitoring recurrent disease (Brown & Schmitz, 2014; Denlinger & Engstrom, 2011). The result is an "underprescription" of exercise, often in favor of pharmacological or surgical interventions (Hoffman et al., 2016, p. 510).

7.2 Cost

Cost serves as a barrier to physicians making exercise referrals to exercise facilities/professionals. Forty-six percent of Dutch GPs cite patients' limited finances as a barrier to referring patients to local exercise facilities, the most commonly cited barrier (Leemrijse et al., 2015). Seventy-two percent of sports medicine physicians factored in health & fitness center cost to patients when referring patients, and ranked expense to patients as the most problematic element for patient referrals (Pojednic et al., 2018). Many health & fitness center programs are available to referred patients either free of charge or at a reduced rate, and when participants complete the programs they can convert to membership at regular prices (Carroll, Ali, & Azam, 2002). Thus, physicians have concerns that patients who are not able to pay the higher costs of using the facilities will revert to their previous routines once the subsidized period is over (Din, Moore, Murphy, Wilkinson, & Williams, 2015). Younger patients referred to facility-based activities blame economic factors as a reason for non-adherence more frequently than older patients (Leijon et al., 2011).

Whereas cost serves as a barrier, reimbursement and subsidies serve as a facilitator to physicians making exercise referrals. Fifty-nine percent of Dutch GPs cite affordable offers as a facilitator to referring patients to local exercise facilities (Leemrijse et al., 2015). In the United Kingdom, ERS are subsidized by the National Health Service, usually for 10-12 weeks, facilitating access to low cost, structured, supervised exercise programs (Harrison, Roberts, & Elton, 2004). Australia is the only country that provides federal government reimbursement for exercise physiologist consultations (Coombes, Law, Lancashire, & Fassett, 2015); specifically, Medicare reimburses up to five exercise physiologist visits annually if the primary care physician creates a chronic disease management plan (Ewald et al., 2018).

Reimbursement and subsidies also serve as a facilitator to patient adherence. U.S. patients who received an exercise prescription/referral from a physician to an exercise facility for 12 weeks averaged 21.41 workouts if the facility fees were fully subsidized by a sponsoring medical organization, versus 16.67 workouts if they were partially subsidized (Shepich, Slowiak, & Keniston, 2007). In some instances, discounted health & fitness memberships are offered during and following the exercise prescription/referral program (Henderson, Evans, Allen-Collinson, & Siriwardena, 2018).

7.3 Training

Current medical training, with its emphasis on “molecules and pills” and other pharmacological methods, may limit the ability of physicians to prescribe exercise (Persson et al., 2013, p. 4). In fact, insufficient training in prescribing and dosing exercise is cited as a primary contributor to the “underprescription” of exercise (Hoffman et al., 2016, p. 510). A survey of U.S. medical school deans revealed that in 2000, only 6% of medical schools had a core course in exercise prescription, and only 10% of graduating medical students could design

an exercise prescription (Connaughton, Weiler, & Connaughton, 2001). More than one-half of physicians trained at U.S. medical schools in 2013 received no formal education in physical activity (Cardinal, Park, Kim, & Cardinal, 2015). Lack of exercise education during medical school and continuing education were the exercise counseling barriers rated second and third most important by 64.8% and 62.8%, respectively, of family physicians in Canada (Kennedy & Meeuwisse, 2003). Only 14.9% of family medicine residents in Canada believe that they have received adequate medical training in exercise prescription, and 91% would like additional training (Solmundson, Koehle, & McKenzie, 2016). Specialty physicians also cite lack of knowledge/skills as a barrier to prescribing exercise: 84% of oncologists do not prescribe exercise to colorectal cancer survivors, acknowledging inadequate understanding about the specific dose of exercise necessary to safely improve outcomes (Brown & Schmitz, 2014).

Physicians need to be trained in physical activity counseling and the specific skills of exercise prescription. Training increases specificity, such as duration and frequency of exercise (Jørgensen et al., 2012). A one-day training workshop on physical activity counseling, motivational interviewing and exercise prescription increased the percentage of Canadian family and specialist physicians providing written exercise prescriptions from 20% to 74% (Fowles et al., 2018). A 3-hour educational workshop on physical activity assessment, motivational techniques and written exercise prescriptions, as well as the provision of exercise prescription pads, increased the proportion of Canadian family physicians providing written exercise prescriptions from 40% to 68% (Windt, Windt, Davis, Petrella, & Khan, 2015).

Training can also increase the extent to which physicians refer patients to community-based exercise facilities and professionals. A prescription pad with space for a community-based referral increased rates of physician referral to community resources in a study of patients in U.S. primary care practices (Flocke, Gordon, & Pomiecko, 2006). U.S.

primary care providers randomized to an intervention group with a 10-minute individualized training session on community-based exercise program referrals versus a control group were significantly more likely to offer referrals in addition to written exercise prescriptions to patients who reported being contemplative of exercise change; as a result, 35% of intervention patients reported regular exercise four months later versus 28% of controls (Ackermann, Deyo, & LoGerfo, 2005). After undergoing six months of tutorials and working group meetings with professionals from sports clubs and private fitness centers, the proportion of Finnish health professionals reporting that they referred their patients to outside exercise professionals increased 7 percentage points (−4.8 to 18.8) (Aittasalo et al., 2016). Physicians are encouraged to identify potential partners within their communities to build effective networks for patient referral, so they are in place when they are needed (Thornton et al., 2016).

The University of South Carolina School of Medicine Greenville is incorporating exercise prescription/referral training into the undergraduate medical curriculum and, in partnership with the Harvard Medical School ILM, modeling the curriculum for other medical schools (Trilk & Phillips, 2014). England has had some success with "embed[ding]" physical activity promotion into clinical practice through the Moving Healthcare Professionals Program (MHPP), a partnership between Public Health England and Sport England, which has delivered face-to-face training to more than 17,000 healthcare professionals, embedded materials in almost three quarters of English medical schools and overseen more than 95,000 e-learning modules (Brannan, Bernardotto, Clarke, & Varney, 2019, p. 1).

7.4 Confidence

Physicians' confidence in counseling on physical activity and writing exercise prescriptions/referrals is often very personal, associated with their personal exercise habits

(Lobelo, Duperly, & Frank, 2009). In fact, physicians' own exercise time of more than 150 minutes per week is an important predictor of confidence in counseling for exercise (Howe et al., 2010). U.S. physicians and medical students who meet physical activity guidelines for vigorous physical activity are significantly more likely than those who do not meet the guidelines to feel confident in counseling their patients about physical activity (OR 2.41, 95 % CI 1.74, 3.34) (Stanford et al., 2014). U.S. physicians and medical students with obesity are less likely to feel confident about physical activity counseling, despite meeting physical activity guidelines for moderate physical activity (OR 0.484, 95 % CI 0.31, 0.76) (Stanford et al., 2014).

Education can significantly increase physicians' confidence in counseling on physical activity and writing exercise prescriptions/referrals. Three months after a one-day training workshop on physical activity counseling, motivational interviewing and exercise prescription, family medicine and specialist physicians in Canada reported greater confidence compared with baseline in providing physical activity advice (71% vs 43%, $p<0.001$) and in identifying which patients would benefit from referral to qualified exercise professionals (77% vs 52%, $p=0.002$) (Fowles et al., 2018). After participating in four training sessions on the 5As approach to physical activity counseling and referring to patients to a community-based exercise program, U.S. family medicine physicians reported feeling significantly more confident in using counseling skills (4.0 vs 3.2, $p=.04$, 5-point Likert scale ranging from 5=very confident to 1=not confident) and referring to community resources to meet patients' needs (3.5 vs 2.1, $p=.004$) (Carroll et al., 2014).

7.5 Electronic Medical Record Systems

Electronic medical records contain patients' medical information in digital format. They are becoming more widespread as U.S. health systems were incentivized to convert to

electronic medical records with the 2009 American Recovery and Reinvestment Act (CDC, 2019). Electronic medical record systems can facilitate physicians writing exercise prescriptions/referrals by prompting exercise questions, printing exercise prescriptions and making exercise referrals based on patient zip code (Bowen, Mankowski, Harper, & Buford, 2019). When medical assistants used an electronic medical record system to document patients' self-reported physical activity as part of the initial visit intake, physicians were more likely to document exercise in their progress notes (26.2 % vs 23.7 % of visits, aOR 1.12 [95 % CI: 1.11–1.13], p<0.001), more likely to counsel on exercise (88 % vs. 76 %, p<0.001), and more likely to make lifestyle-related referrals (2.1 % vs 1.7 %; aOR 1.14 [1.11– 1.18], p<0.001) (Grant, Schmittdiel, Neugebauer, Uratsu, & Sternfeld, 2014).

8. Trusted Health & Fitness Centers/Exercise Professionals

What are characteristics of health & fitness centers and exercise professionals that physicians would trust to refer their patients?

8.1 Physician Trust/Credibility

Patients trust their physicians: trust is central to the patient-physician relationship (Pearson & Raeke, 2000). Physicians are generally viewed as credible sources of preventive health information in general and physical activity advice in particular (Croteau, Schofield, & McLean, 2006). The primary care setting was found to be the most trusted source of physical activity information, with 78.5% of respondents in a nationally representative survey in New Zealand indicating trust in their GP for physical activity information (Schofield, Croteau, & McLean, 2005). Older patients, physically inactive patients and patients with chronic disease are more likely to trust their GP for physical activity information (Schofield et al., 2005). In one randomized trial, 93% of patients reported agreeing with the statement, "If my doctor advised

me to exercise, I would follow his or her advice" (Andersen, Blair, Cheskin, & Bartlett, 1997, p. 396).

Physically active physicians can serve as role models for patients (Lobelo & de Quevedo, 2016), leading by example. They are also more likely to counsel their patients on physical activity (Hébert et al., 2012), and more likely to recommend activities with which they have personal experience (Pojednic et al., 2017). Physically active physicians believe that their own physical activity level makes them a credible source of advice to patients, and report opportunistically promoting physical activity during office visits (Din et al., 2015).

8.2 Health & Fitness Center Trust/Credibility

Physicians need trusted exercise facilities to which they can refer patients. They trust what they know. Personal familiarity with health & fitness centers correlates with a positive view of them, which in turn correlates with the belief that they are appropriate places for referral (Pojednic et al., 2018). Nineteen percent of Dutch GPs identified limited knowledge of local exercise facilities as a reason for not referring patients (Leemrijse et al., 2015).

Physicians cite location as important in their referral, recognizing that patients who receive exercise prescriptions/referrals from physicians may be influenced by geographic proximity and access to community-based exercise facilities (Petrella, Kennedy, & Overend, 2008). A lack of facilities in the vicinity of the referring physicians' practices where patients could follow through on exercise referrals was identified as a major barrier to referral in an ERS (Din et al., 2015). Sixty-five percent of sports medicine physicians factored in health & fitness center convenience for patients when referring patients, and cited convenience as the second most problematic element for patient referral (Pojednic et al., 2018).

8.3 Exercise Professional Trust/Credibility

Physicians also need trusted exercise professionals to which they can refer patients. Physicians' trust levels in exercise professionals vary country-to-country. Only about 5% of Dutch GPs mentioned personal trainer inexperience and safety concerns as a barrier to referring patients (Leemrijse et al., 2015), whereas concerns about "poorly trained" personal trainers contributed to only 21% of ACSM sports medicine physicians referring their patients to personal trainers (Pojednic et al., 2018, p. 4). Similarly, exercise professionals in a U.K. ERS identified a "lack of understanding" and a "massive divide" between GPs and exercise professionals: "maybe they don't trust who they're referring to" (Henderson et al., 2018, ERS delivery section).

Patients need to have trust in exercise professionals, too. Almost half (44.2%) of respondents in a nationally representative survey in New Zealand indicated trust in personal trainers/gym staff for physical activity information, compared to 78.5% trusting GPs (Schofield et al., 2005). Exercise professionals found that they became valued and trusted components of patients' social networks as they supported them through a U.K. ERS program (Moore, Moore, & Murphy, 2011).

8.4 Collaboration and Communication

Collaboration and communication between physicians and exercise professionals is critical for facilitating referrals to exercise facilities and professionals. Almost one-third (32%) of Dutch GPs mentioned good collaboration with trainers as a facilitating factor for referring more patients to community-based exercise facilities (Leemrijse et al., 2015). GPs note a desire to see feedback from exercise professionals because it provides insight into patient motivation and commitment to behavior change (Henderson et al., 2018).

Often the patient plays an important role in connecting the clinical setting and the community-based exercise facilities and professionals: 67% of GPs cited positive experiences for patients at local exercise facilities as a facilitator—the most important facilitator—for referring more patients (Leemrijse et al., 2015). Conversely, physicians cited lack of feedback on patients' progress as a major barrier to referral. "... I do not know what happened to the patients once we referred ... I just tend not to refer any more …" (Din et al., 2015, p. 751).

9. Patient Exercise Behavior Change

What is the impact of physician exercise prescriptions/referrals on patient exercise behavior?

9.1 Uptake and Adherence - Patients Filling Exercise Prescriptions/Referrals

Patients filling exercise prescriptions/referrals is measured by both uptake, i.e., initial follow-up, and adherence, i.e., continued follow-up (Pavey et al., 2012). Adherence is "the extent to which a person's behavior—taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a healthcare provider" (WHO, 2003, p. 3). Adherence to exercise prescriptions/referrals was found to be as good as or even better than adherence to other treatments for chronic diseases, including medication: 65% compared with an average of 50% adherence to long-term therapies in developed countries (Kallings, Leijon, Kowalski, Hellénius, & Ståhle, 2009; WHO, 2003).

In a systematic review and meta-analysis of ERS, the pooled level of uptake was 66% (95% CI 57% to 75%) across the observational studies and 81% (95% CI 68% to 94%) across the Randomized Controlled Trials (RCTs); the pooled level of ERS adherence was 49% (95% CI 40% to 59%) across the observational studies and 43% (95% CI 32% to 54%) across the RCTs (Pavey et al., 2012). Another systematic review of ERS showed that longer length ERS (20 or

more weeks) had higher adherence to exercise prescribed than shorter length ERS (8-12 weeks) (Rowley, Mann, Steele, Horton, & Jimenez, 2018). An evaluation of one U.K. ERS revealed the progression of uptake to adherence to completion: 81% uptake, 53.5% adherence at 12 weeks, and 42.9% completion at 24 weeks (Hanson, Allin, Ellis, & Dodd-Reynolds, 2013).

Increasing age is a statistically significant predictor of higher levels of uptake and adherence to exercise prescriptions/referrals, attributed to age-related reduction in time constraints (Harrison, McNair, & Dugdill, 2005; James et al., 2008; James et al., 2009). In fact, for every 10 year increase in age, the odds of patients adhering to exercise prescribed in an ERS increased 21.8% (OR = 1.02; CI = 1.00 to 1.04; p = 0.03) (Tobi et al., 2012). So, too, are risk factors prompting the exercise prescription/referral a statistically significant predictor of uptake (Harrison et al., 2005).

Almost two-thirds (65%) of patients receiving exercise prescriptions/referrals through the PAP program reported adherence at 6-month follow-up, with 19% reporting partial adherence and 16% reporting non-adherence (Kallings et al., 2009). Self-reported reasons for non-adherence included “sickness,” “pain,” “no time,” “economic factors,” and “low motivation;” “low motivation” was a more common reason for non-adherence for those prescribed home-based activities compared with those referred to facility-based activities (Leijon et al., 2011, p. 234). Patients who adhered more reported more self-efficacy—belief in their capability of carrying out a behavior— to overcome barriers to exercise versus those who adhered less (Bandura, 1977; Edmunds, Ntoumanis, & Duda, 2007).

9.2 Short- to Medium-term Patient Exercise Behavior Change

There is a significant practice gap in follow-up of patients receiving exercise prescriptions/referrals (Soan et al., 2014). This leads to questions about the efficacy of

exercise prescriptions/referrals—especially referrals to short (10-12 week) supervised exercise programs—in bringing about exercise behavior change once the program has completed. Some studies have demonstrated that patient exercise behavior change after receiving exercise prescriptions/referrals was significant up to 12 months. In a systematic review of ERS, the proportion of patients achieving 90–150 minutes of at least moderate-intensity physical activity per week at 6–12 months' follow-up was greater for ERSs than usual care (RR 1.12; 95% CI 1.04 to 1.20) (Campbell et al., 2015). In one study included in the systematic review, when community-based exercise facilities providing the exercise referral were randomized, the proportion of patients achieving at least 150 minutes of moderate physical activity per week increased in the standard ERS group from 27% at baseline to 63% at 3 months and 46% at 6 months (Duda et al., 2014). In another study included in the systematic review, patients randomized to ERS increased physical activity at 12-month follow-up compared to those receiving normal care in all participants (OR 1.19, 95% CI 0.99 to 1.43), and among those referred for coronary heart disease risk factors only (OR 1.29, 95% CI 1.04 to 1.60) (Murphy et al., 2012).

However, in other U.K. ERS studies, the effects were small and/or not sustained, and patients failed to achieve the recommended 150 minutes of moderate physical activity per week. In one evaluation study, patients who adhered until the end of a 12-week ERS were able to achieve only a mean increase of 27 minutes per week, and to sustain at 12-month follow-up only a mean increase of 21 minutes per week compared with baseline (Dugdill, Graham, & McNair, 2005). A second study assessing ERS plus written information versus written information only found that a statistically significant 9% increase in participation in 90 minutes of moderate-to-vigorous physical activity per week at 6-month follow-up (22.6 versus 13.6 per cent,

OR 1.67, 1.08 to 2.60, p=0.05) became a non-significant 5% increase at 12-month follow-up (25.8 versus 20.4 per cent, OR 1.45, 0.84 to 2.50, p=0.18) (Harrison et al., 2004).

Two studies showed significant physical activity increases at 6-month follow-up in patients receiving an exercise prescription/referral through a Swedish PAP program. At 6-month follow-up, 73% of patients with metabolic risk factors increased their physical activity levels, and 42% moved from inadequate to sufficient physical activity levels (Lundqvist, Börjesson, Larsson, Hagberg, & Cider, 2017). In addition, patients changed behavior to a more physically active lifestyle at 6-month follow-up, as measured by self-reported physical activity level and readiness for change (Kallings, Leijon, Hellénius, & Ståhle, 2008).

Two additional studies showed significant physical activity increases at 12-month follow-up in patients receiving an exercise prescription/referral through the Swedish PAP program. Half of patients reported increased physical activity at 3-month follow-up (49%) and 12-month follow-up (52%), and the proportion of patients who were physically active on a regular basis increased from 22% at baseline to 33% at 3-month follow-up and 32% at 12-month follow-up (Leijon et al., 2009). In addition, physically inactive patients with lifestyle-related health problems significantly increased physical activity, and the rate of physically inactive individuals decreased from 75% to 53% at the 12-month follow-up (Romé, Persson, Ekdahl, & Gard, 2014).

Two studies showed significant physical activity increases at 12-month follow-up in patients receiving an exercise prescription/referral through the New Zealand GRx program. When general practices were randomized, the proportion of patients achieving 2.5 hours per week of moderate or vigorous physical activity increased by 9.72% (p=.003) over the control group at 12-month follow-up (Elley et al., 2003). In addition, in a retrospective survey of a nonrandomized group of patients receiving GRx, 56% reported increases in physical activity

level, with 70% remaining physically active (30 min per day on 3.4 ± 2.5 days per week) (Sinclair & Hamlin, 2007).

The ERS, PAP and GRx programs are initiated primarily in the primary care setting, but studies of specialty physicians writing exercise prescriptions/referrals also demonstrated patient exercise behavior change at 6-month and 12-month follow-up. The strongest independent predictor of 6-month follow-up exercise behavior in lymphoma patients randomized to a 12-week supervised exercise program was acceptance of a post-program exercise prescription (Courneya et al., 2012). Breast cancer patients receiving an exercise prescription/referral to an evidence-based, supervised exercise and healthy eating program from their oncologists significantly increased (116 ± 14 to 154 ± 14 minutes per week, p=.014) their moderate-to-vigorous physical activity from baseline to the end of program (during adjuvant therapy plus 20 weeks) and maintained it at 12-month follow-up (171 ± 24 minutes per week, p=.014) (Kirkham et al., 2018).

9.3 Long-term Patient Exercise Behavior Change

Long-term follow-up is a critical factor when assessing sustained exercise behavior change. The study with the longest term follow-up was 24 months. When patients were randomized to a GRx program versus usual care the percentage of intervention participants achieving 150 minutes of at least moderate intensity physical activity per week increased from 10% at baseline to 43% at 12 months to 39.3% at 24 months; the comparable percentages for control participants were 11%, 30%, and 32.8% (p<.001), respectively (Lawton et al., 2008). In a 16-month study, one in three participants in an EoP program in Denmark who increased their self-reported physical activity level at 4 months also maintained it at 10-month follow-up and 16-month follow-up (Sørensen, Sørensen, Skovgaard, Bredahl, & Puggaard, 2010). At 15

months, in patients in Spanish primary care centers randomized to a 12-week ERS intervention group (IG) and a control group (CG), there was a significant increase of self-reported physical activity (IG: 1373±1845 metabolic equivalents (MET) min/week, n=195; CG: 919±1454 MET min/week, n=144; P=0.009) (Martín-Borràs et al., 2018).

Other studies found less of a sustained effect in patient exercise behavior change. In other words, increased physical activity levels in the short- to medium-term wore off in the long-term. For example, the greatest differences in physical activity levels between the intervention group and the control group receiving physical activity advice and written exercise prescriptions were observed at six months (adjusted difference 1.7 MET*hr/wk [95% CI, 0.8 to 2.6], 25 min/wk [95% CI, 11.3 to 38.4], and a 5.3% higher percentage of patients meeting minimum recommendations [95% CI: 2.1% to 8.8%] NNT = 19), but these differences were not statistically significant at 12-month follow-up and 24-month follow-up (Grandes et al., 2011). Although patients receiving exercise prescriptions/referrals through the PAP program showed a significant increase in self-reported physical activity levels at the 6-month and 12-month follow-up, the trend at the 24-month follow-up was ongoing but non-significant (p=.09) (Rödjer, Jonsdottir, & Börjesson, 2016).

9.4 Social Support

Social support is an important facilitator to patients filling exercise prescriptions/referrals and changing exercise behavior. Social support refers to “informative, emotional or instrumental support that enhances recipients’ self-esteem or provides stress-related interpersonal aid” (Dumont & Provost, 1999, p. 345). Three systematic reviews of ERS revealed the role that social support plays in adherence and long-term exercise behavior change: participants value peer, family, friend, provider and exercise professional support as important for adherence and

longer-term physical activity (Morgan et al., 2016); social support networks promote adherence and long-term improvements in levels of physical activity (Campbell et al., 2015); and, poor social support is a reason for non-adherence (Williams et al., 2007). An ERS with mechanisms to promote social support and social participation enhanced adherence among insufficiently active patients over a 15-month period (Martin-Borràs et al., 2018). A mixed methods study of an ERS found that social support from professionals and peers may be critical for optimum perception of success (Mills, Crone, James, & Johnston, 2012).

9.5 Technology/Self-Monitoring

Technology and self-monitoring are important facilitators to patients filling and adhering to exercise prescriptions/referrals, and patient exercise behavior change. In a randomized trial of three strategies to promote physical activity in a primary care setting, patients who received brief advice from a GP, behavior change advice from an exercise physiologist, and a pedometer were more likely (OR=2.39 95% CI: 1.01, 5.64) to meet physical activity guidelines at 6-month follow-up than patients who received advice from a GP alone (Armit et al., 2009). In patients randomized to a pedometer-based GRx group or a standard GRx group, at 12-month follow-up, leisure walking increased by 49.6 minutes per week for the pedometer-based GRx group compared with 28.1 minutes week for the standard GRx group (p=.03) (Kolt et al., 2012). When physicians prescribing exercise through a Finland PAP program were randomized to a prescription and non-prescription group and half of the non-prescription group patients received a pedometer and physical activity log, the mean increase in weekly overall physical activity at 2-month follow-up was 1.0 session more (95% CI 0.0 to 2.0) in the prescription group than the control group; compared to the control group, self-monitoring increased the weekly duration of

overall PA at 2-month follow-up on average by 217 minutes (95% CI 23 to 411) (Aittasalo et al., 2006).

10. Gaps in Literature/Building the Evidence Base

In 2002, the United States Preventive Services Task Force examined whether counseling by physicians, including written exercise prescriptions, improves patient physical activity (Eden, Orleans, Mulrow, Pender, & Teutsch, 2002). It determined there were too few studies and too few details to make a conclusion about the relationship between interventions and reported efficacy (Eden et al., 2002). Sixteen years later, the 2018 Physical Activity Guidelines Advisory Committee Scientific Report found the current state of the evidence suggests “limited efficacy” for brief physical activity interventions during clinic visits significantly increasing physical activity (HHS, 2018a, p. F11-40). However, it acknowledged that the primary care setting presents a “scalable opportunity” to influence population-level physical activity, and efficacy may be enhanced through certain strategies supplemented with written exercise prescriptions (HHS, 2018a, p. F11-40).

In order to realize this scalable opportunity to influence population-level physical activity and enhance the efficacy of physician physical activity counseling, there needs to be an expanded evidence base on the effectiveness of exercise prescriptions/referrals in changing patient exercise behavior. Most of the current evidence base is around three exercise prescription/referral programs: ERS, PAP, and GRx. The programs vary significantly in structure, which makes it very challenging to make generalizations about the extent to which exercise prescriptions/referrals delivered in a clinical setting impact patient adherence and exercise behavior change. Moreover, it makes it challenging to translate the evidence from nationwide exercise prescription/referral programs with all licensed primary care physicians and

nurses making exercise prescriptions/referrals, such as in Europe and New Zealand, to a U.S. setting.

In 2014, Exercise is Medicine® was transitioning from its initial phase of infrastructure and awareness-building to its next phase of program implementation and evaluation (Lobelo et al., 2014; Tuller, 2015). Although Exercise is Medicine® is the most highly visible exercise prescription/referral program in the United States, there are only a handful of peer-reviewed publications on Exercise is Medicine®, and most are calls to action exhorting physicians to assess, record, counsel on, and prescribe exercise (Joy, Blair, McBride, & Sallis, 2013; Sallis, 2009; Sallis, 2011; Sallis, 2015; Sallis, Baggish, Franklin, & Whitehead, 2016; Sallis et al., 2015). Some even frame it as the "obligation" of physicians to prescribe exercise to sedentary patients (Chakravarthy, Joyner, & Booth, 2002). Only one publication examines the effectiveness of Exercise is Medicine® in changing short-term patient exercise behavior. It found that patients exposed to clinic-based Exercise is Medicine® protocols and referred to community-based exercise facilities and professionals significantly increased (by 250 minutes per week) their self-reported moderate, vigorous and total physical activity from baseline to 3-month follow-up, more than patients exposed to clinic-based Exercise is Medicine® protocols alone (decrease of 38.6 minutes per week) (Heath, Kolade, & Haynes, 2015). In the only other U.S. study, also short-term, patients randomized to a written exercise prescription group, a written exercise prescription plus toolkit group and a written exercise prescription plus guide group increased their physical activity levels at 3-month follow-up, and written prescription plus exercise toolkit was associated with the greatest increase in physical activity (Josyula & Lyle, 2013).

In conclusion, there is evidence for high patient uptake and adherence to exercise prescriptions/referrals and a generally positive impact on short-term patient exercise behavior

change. However, there is some conflicting evidence on short-term exercise behavior change and even more conflicting evidence on the sustained effect of patient exercise behavior change. In order to connect the clinical and community settings to influence population-level physical activity in the United States, it is important to build the evidence base in three critical areas: 1) the impact on patient exercise behavior of different types of program structures used to deliver exercise prescriptions/referrals; 2) the impact on patient exercise behavior of different types of partnerships between the clinical setting and community-based exercise facilities to which patients are referred; and 3) facilitators to patient adherence and behavior change that increase the effectiveness of exercise prescriptions/referrals in changing patient exercise behavior, including new technology such as social media and health & fitness apps. Only then will this scalable opportunity in the clinical setting, and the full power of exercise as (even better than) medicine, be fully realized.

11. Framework for Change

The social ecological model is a theory-based framework that focuses on individual behaviors within the context of interpersonal (e.g., social support), organizational (e.g., social institutions), community (e.g. relationships between organizations), and policy/environment (e.g. local, state, national laws) (McLeroy, Bibeau, Steckler, & Glanz, 1988). These are the five levels of the social ecological model and each level—and the interrelationship between the levels—influences exercise behavior.

Social ecological approaches to changing exercise behavior view individual-level factors such as motivation and self-efficacy as important, yet also consider interpersonal, organizational, community and policy/environment-level influences beyond the individual, such as physician and exercise professional support and exercise facility access (Littlecott, Moore,

Moore, & Murphy, 2014; Stenman et al., 2012). Successful initiation of exercise prescription/referral in a clinical setting and delivery in a clinical or community setting depends on a combination of strengthening individual motivation and capability and a systems (social ecological model) approach (Börjesson & Sundberg, 2013)

The 2018 Physical Activity Guidelines Advisory Committee Scientific Report (2018a) applies the social ecological model in reviewing the current evidence base in physical activity promotion. Given that the goal is to realize the potential of the clinical setting as a "scalable opportunity" to influence population-level physical activity, it is important to apply a social ecological lens that views physical activity as a result of multiple influences at various levels (HHS, 2018a, p. F11-40; McLeroy, Norton, Kegler, Burdine, & Sumaya, 2003).

12. Mixed Methods Research Design

12.1 Study Site

Hospital AZ (an alias) is a New England healthcare organization with a hospital, and 26 primary care and specialty care provider practices. Health & Fitness Center O (an alias) is a health & fitness center that operated as a for-profit facility for a decade before it was acquired by Hospital AZ. Health & Fitness Center O has a wellness center with dedicated physical space and wellness professionals, including exercise professionals, health coaches and Registered Dietitians (RDs). It began accepting medical referrals over a decade ago, and medical referrals currently average 35 per week. Approximately 80% of medical referrals are from Hospital AZ physicians. Hospital AZ physicians generally refer patients to one of the four programs offered by Health & Fitness Center O, which include: an 8-week exercise program for post-rehab (musculoskeletal, cardiac, and pulmonary); a 13-week fitness, nutrition, stress management and behavior modification program; a 12-month program weight management program; and 3-month

cancer recovery program. Hospital AZ physicians also refer to local community-based health & fitness centers, or independent exercise professionals. Health & Fitness Center O charges $30 per month for the duration of its programs, and the monthly appointments with the RD in the weight management program are billed to insurance.

12.2 Study Design and Protocol

This mixed methods research study used the sequential explanatory design (Creswell, Plano Clark, Gutmann, & Hanson, 2003) and was completed in two phases. Phase one was a quantitative survey sent to 259 physicians at Hospital AZ and 19 exercise professionals at Health & Fitness Center O. The physician survey aimed to understand physician practices in writing exercise prescriptions/referrals and physicians' perspectives on patient adherence to exercise prescriptions/referrals. The exercise professional survey aimed to understand how exercise professionals communicate and collaborate with physicians about referred patients and exercise professionals' perspectives on exercise prescriptions/referrals and patient exercise behavior change.

Phase one was conducted in September and October 2019. The physician survey was administered via REDCap, a secure data collection tool, and sent electronically by the medical staff office to all active Hospital AZ physicians. Only Hospital AZ physicians write exercise prescriptions/referrals, so Hospital AZ nurses and nurse practitioners were not included. A follow-up reminder was sent after 9 days. The exercise professional survey was also administered via REDCap and sent electronically to all Health & Fitness Center O exercise professionals by Health & Fitness Center O staff.

Phase two was semi-structured qualitative interviews with physicians and exercise professionals who opted in through the surveys. It was conducted in October through

December 2019. Interview participants were offered the option of being interviewed via telephone or in person. The invitations to participate in the surveys and the follow-up interviews included the purpose of the study, details of consent, confidentiality and contact information for the researcher. The project was reviewed by Hospital AZ IRB and found to be exempt based on HHS regulations for the protection of human subjects in research 45 CFR 46.104 (d); it was also reviewed by Harvard IRB and found to be "not human subjects research" based on HHS regulations for the protection of human subjects in research 45 CFR 46.102 (1).

12.3 Data Collection Instruments

The physician and exercise professional surveys comprised 11 and 13 questions, respectively. Questions were multiple choice, five-point Likert scale, matrix and open-ended. The survey and semi-structured interview guide comprised three sections. The focus of the first section was practice patterns: whether/how physicians prescribe exercise and how exercise professionals work with patients referred by their physicians. The focus of the second section was barriers and facilitators: barriers and facilitators to physicians writing and patients filling exercise prescriptions/referrals. The focus of the third section was trust and feedback loop: what characteristics of exercise facilities and professionals would make physicians more likely to refer their patients and collaboration between physicians and exercise professionals about referred patients. All four data collection instruments—the physician survey, the physician interview guide, the exercise professional survey and the exercise professional interview guide—are included as Appendices.

12.4 Data Analysis

As is consistent with the explanatory sequential design, the quantitative data was first collected via the physician and exercise professional surveys and analyzed using STATA to

generate descriptive statistics (see Figure 4). Second, it was determined what quantitative data needed to be further explained by the qualitative data. Third, the qualitative data was collected via the semi-structured interviews with physicians and exercise professionals. The interviews were audiotaped and transcribed verbatim. Transcripts were analyzed using a framework approach to thematic analysis (Rivas, 2012). This deductive approach to coding, using charts and matrices, facilitated the matching of themes between the quantitative and qualitative data. Fourth, once the themes were analyzed for the connection between the quantitative and qualitative data, the qualitative data was interpreted to help explain the quantitative results.

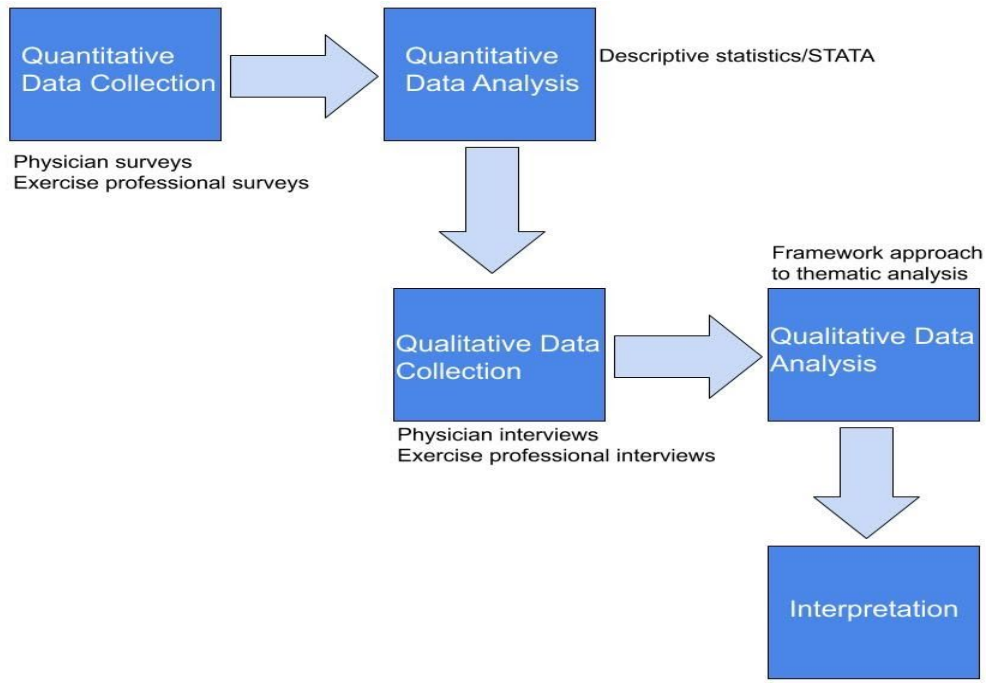

Figure 4. Mixed Methods Explanatory Sequential Design. Adapted from "Advanced mixed methods research designs" (Creswell et al., 2003).

III. RESULTS

1. Research Aims

This study used a mixed methods research design to understand physicians' and exercise professionals' perspectives on exercise prescriptions/referrals and patient exercise behavior change. It aims to help determine the potential of using the clinical setting to influence population-level physical activity by having physicians counsel patients on physical activity, write exercise prescriptions, and refer patients to exercise facilities and professionals.

The surveys and interviews explicitly asked physicians and exercise professionals about best practices for writing exercise prescriptions/referrals, and what an "ideal prescription/referral" looks like. A better understanding of evidence-based physician practices around exercise prescriptions/referrals is intended to inform effective approaches in the clinical setting to influence population-level physical activity.

The surveys and interviews also explicitly asked physicians and exercise professionals about barriers and facilitators to writing exercise prescriptions/referrals. Deeper knowledge of these barriers and facilitators aims to help the study site address them. In fact, the recommendations include ten steps Hospital AZ can take to address barriers to physicians writing exercise prescriptions/referrals. In addition, these recommendations have repercussions for other healthcare organizations beyond Hospital AZ. Disseminating these recommendations to a wider audience has the potential to increase the number of U.S. physicians counseling their patients on physical activity and writing exercise prescriptions/referrals.

This study included a strong focus on identifying the characteristics of health & fitness centers and exercise professionals that physicians would trust to refer their patients. Shedding light on physicians' and exercise professionals' perspectives on the types of facilities and people

that physicians would trust to take good care of patients has important implications for health & fitness centers and exercise professionals. In fact, the recommendations include ten steps health & fitness centers can take to become community resources that physicians would trust to refer their patients. This study aims to help establish these community resources as an important and effective component of a population-based response to increasing physical activity and reducing sedentary behavior.

Finally, the surveys and interviews explicitly asked physicians and exercise professionals about their perceptions of how exercise prescriptions/referrals change patient exercise behavior, and how they collaborate to facilitate patients filling exercise prescriptions/referrals. This study aims to inform future research on the impact of exercise prescriptions/referrals in increasing physical activity and reducing sedentary behavior.

2. Participants

Fifty (19%) of 259 physicians at Hospital AZ responded to the physician survey. Fourteen of the physicians were primary care physicians, and 35 were specialists, including anesthesiology, emergency medicine, OB/GYN, orthopedics, physiatry, radiology, and surgery. One physician did not indicate either primary care or specialty. Seven physicians, primarily specialists but also primary care physicians, were interviewed. Twelve (63%) of 19 exercise professionals at Health & Fitness Center O responded to the exercise professional survey. Six of the exercise professionals were personal trainers, and six were health coaches, RDs, or wellness managers. Five exercise professionals were interviewed.

3. Evidence-based Physician Practices

What are evidence-based physician practices around exercise prescriptions/referrals?

3.1 Writing Prescriptions

The literature reveals a significant additional impact of written exercise prescriptions/referrals on patient exercise behavior over advice alone. When asked how often they provide written exercise prescriptions/referrals to their patients, half of physicians do "always" (0%), "very often" (22%) or "sometimes" (28%). Half of physicians do "rarely" (20%) or "never" (30%) (see Figure 5). For all physicians, the mean frequency of writing exercise prescriptions/referrals was 2.42 (SD 1.14; 5=always; 1=never), almost midway between "sometimes" and "rarely."

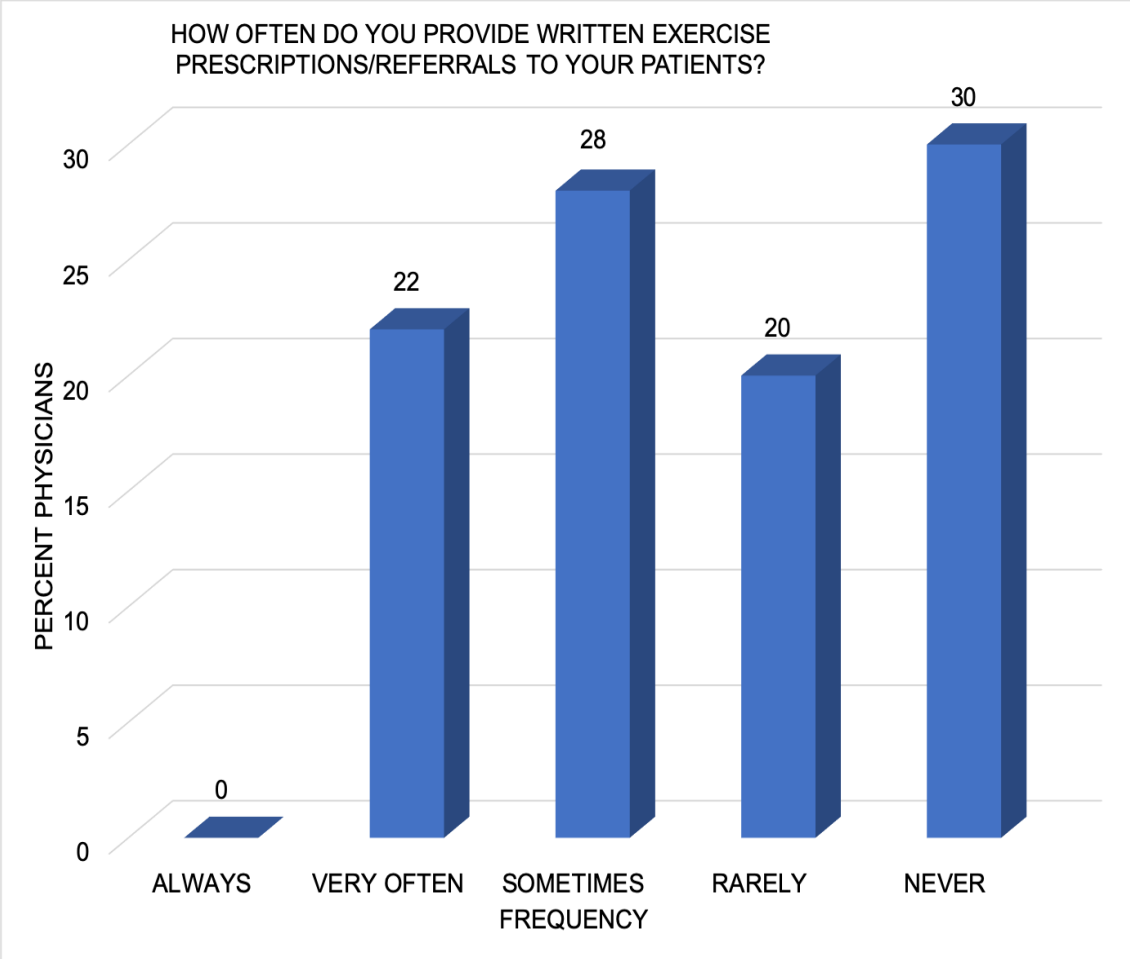

Figure 5. Frequency of Physicians Surveyed Writing Exercise Prescriptions/Referrals.

Comparing primary care physicians and specialists, 71% of primary care physicians versus 43% of specialists provide written exercise prescriptions/referrals to their patients "very often" or "sometimes." Forty percent (40%) of specialists "never" provide written exercise prescriptions/referrals to their patients. This varies by specialty, with physiatrists and orthopedists prescribing "very often" or "sometimes," and radiologists and anesthesiologists noting that they do not prescribe anything, including exercise. Only a single primary care physician "never" provides written exercise prescriptions/referrals.

For primary care physicians, the mean frequency of writing exercise prescriptions/referrals was 2.93 (SD .92; 5=always; 1=never), whereas for specialists, the mean frequency was 2.23 (SD 1.19). There was no statistically significant difference between primary care physicians and specialists in the mean frequency (p=.054) or median frequency (p=.057) of writing exercise prescriptions/referrals.

Physicians report that their exercise instructions tend to be more verbal than written:

> *I try to counsel everybody that is appropriate, which is...just about 100% of patients unless they are already doing it. I don't prescribe exercise with a piece of paper or on the computer. I don't know how to do that… this is kind of a fascinating idea.* (Physician)

Physicians who do provide written exercise prescriptions/referrals check a referral box in the electronic medical record system or use written handouts with exercise instructions for patients to do on their own or to take to an exercise facility or exercise professional. Some physicians write exercise instructions down as part of the patient plan for the office visit but may not write it in the form of a prescription or view it as a prescription.

3.2 Identifying Risk Factors/Conditions

Overweight/obesity is the most cited risk factor/condition prompting physicians—specifically, 64% of physicians surveyed—to write exercise prescriptions/referrals (see Table 1).

Table 1. Physicians' Perspectives on Risk Factors Prompting Exercise Prescriptions/Referrals (n=50)

Risk Factor	Percent of Physicians (%)
Overweight/obesity	64
Musculoskeletal issues	54
Diabetes/prediabetes	48
General wellness/prevention	48
Hypertension/prehypertension	44
Mental health condition	42
Post-op/rehabilitation	38
High cholesterol	32
Not exercising regularly	30

Correlations were determined to understand whether one risk factor/condition prompting physicians to write exercise prescriptions/referrals was associated with another risk factor/condition. Diabetes and hypertension (r=.92), hypertension and high cholesterol (r=.77), diabetes and mental health (r=.72), overweight/obesity and diabetes (r=.72), hypertension and mental health (r=.72), and diabetes and high cholesterol (r=.71) were statistically significant and most strongly correlated. Overweight/obesity and diabetes appeared together in almost half of the responses (48%), followed closely by diabetes and hypertension (44%).

Physicians home in on diagnoses that would benefit from exercise when writing exercise prescriptions/referrals:

> *It tends to be diagnosis-based. So, folks that are coming in with a lot of chronic disease are the people I probably focus on, give recommendations to.* (Physician)

They also refer to certain risk factors/conditions influencing their approach to exercise prescriptions/referrals:

> *If patients are...requiring more and more medications for their hyperlipidemia or hypertension, I choose a more proactive method for exercise referrals.* (Physician)

Interestingly, only 30% of physicians noted "I established the patient was not exercising regularly" as a risk factor/condition prompting them to write exercise prescriptions/referrals. Forty-three percent (43%) of primary care physicians versus 23% of specialists identify "not exercising regularly" as a risk factor/condition prompting them to write exercise prescriptions/referrals, which was not a statistically significant difference (p=.16). The odds of primary care physicians identifying "not exercising regularly" as a risk factor are 2.5 times the odds of specialists identifying "not exercising regularly" as a risk factor, which was not a statistically significant difference (p=.16).

3.3 Tailoring Prescriptions

The literature supports individualized, specific exercise prescriptions facilitating patient follow-through. When asked what type of exercise prescriptions/referrals they write, only 6% of physicians provide patients with a personalized exercise prescription with dosage information, to be filled at a fitness facility. In comparison, 22% of physicians provide patients with a personalized exercise prescription with dosage information, to be filled at home. Only 4% of physicians provide both types of personalized exercise prescriptions, whereas 76% of physicians provide neither type of personalized exercise prescription.

Physicians who do not tailor prescriptions base them on the standard exercise guidelines:

> *It is not a very detailed prescription per se. So we basically discuss minimum durations, and the intensity sometimes but it is not very detailed.* (Physician)

Physicians who do tailor prescriptions go into significantly more detail about specific exercises:

> *If I think it is appropriate, I may be more prescriptive for them. Because I will go through exactly what they can and can't do.* (Physician)

3.4 Refilling Prescriptions

The literature indicates that repeated interventions, such as prescription refills and booster programs, enhance the long-term effectiveness of physician exercise advice. Physicians describe a system of referring patients into programs at the hospital-affiliated health & fitness center, and of receiving before and after health risk assessment results. However, the "closing the loop" process does not include a formal mechanism for refilling exercise prescriptions/referrals.

Exercise professionals do not have a way of tracking patients who have completed the programs that they were referred into unless the patients convert to membership:

> *Once they are done with our programs, if they don't continue on here as a gym member, I don't have any follow-up with them* (Exercise Professional)

3.5 Referring to Exercise Facilities/Professionals

The literature shows that referral to exercise facilities and professionals facilitates patient exercise behavior change. When asked what type of exercise prescriptions/referrals they write, 56% of physicians refer to a hospital-affiliated health & fitness center versus 22% who refer to community-based health & fitness centers unaffiliated with a hospital.

Eight-three percent (83%) of physicians are “very comfortable” or “comfortable” referring patients to a hospital-affiliated health & fitness center. In comparison, only 38% of physicians are “very comfortable” or “comfortable” referring patients to a community-based health & fitness center. Even fewer—26% of physicians—are “very comfortable” or “comfortable” referring patients to an independent fitness provider not in a facility.

Almost half (49%) of physicians are “neutral” about referring patients to an independent fitness provider, with 40% “neutral” about referring patients to a community-based health & fitness center. A full 23% and 26% of physicians are “uncomfortable” or “very uncomfortable” referring patients to a community-based health & fitness center or an independent fitness provider, respectively.

For all physicians, the mean comfort level of referring to a hospital-affiliated health & fitness center was 4.36 (SD .76; 5=very comfortable; 1=very uncomfortable). The mean comfort level of referring to a community-based health & fitness center was 3.19 (SD 1.10), and the mean comfort level of referring to an independent fitness provider was 3.02 (SD 1.05) (See Figure 6). There was a statistically significant difference (p=.0001) in mean comfort level referring to hospital, community-based and independent exercise facilities/professionals.

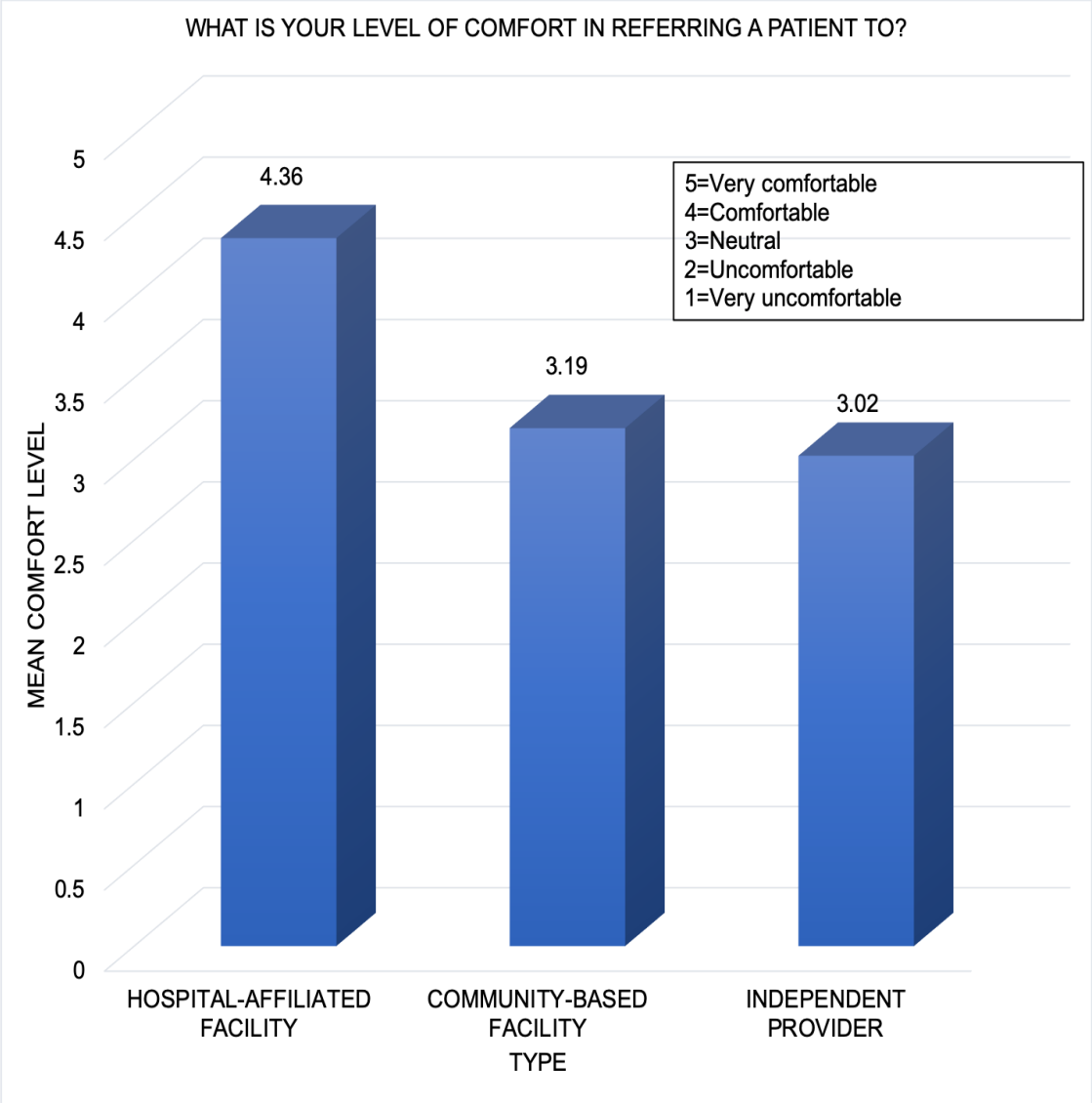

Figure 6. Physicians' Comfort Level in Referring Patients to Different Facility Types.

When asked how often they work with patients referred by a physician, 83% of exercise professionals respond "always" (25%), "very often" (25%), or "sometimes" (33%). For all exercise professionals, the mean frequency of working with patients referred by a physician was 3.58 (SD 1.08; 5=always; 1=never), almost midway between "very often" and "sometimes:"

> *Here, the people I see have also been referred by their PCP. I don't currently...see anyone who has not been referred.* (Exercise Professional)

In addition to writing exercise prescriptions/referrals to the hospital-affiliated health & fitness center, community-based health & fitness centers and independent fitness providers, physicians also mention writing exercise prescriptions/referrals to health coaches or athletic trainers affiliated with their practices, as well as physical therapists.

3.6 Using Motivational Interviewing

The 2018 Physical Activity Guidelines Advisory Committee Scientific Report identifies exercise prescriptions in combination with motivational interviewing as a more robust strategy to enhance the efficacy of physical activity interventions in the clinical setting (HHS, 2018a).

There is clearly a need to motivate patients, as "lack of motivation" by the patient is the most cited barrier by physicians—specifically, 40% of physicians—to their writing exercise prescriptions/referrals. It is the second most cited barrier by exercise professionals to patients filling an exercise prescription/referral.

Motivational interviewing was explicitly named only once, by an exercise professional:

> *It might be more of motivational interviewing to try to figure out how are we going to help them identify that these are barriers, and then they generate the plan themselves.* (Exercise Professional)

That said, exercise professionals speak of many of the tenets of motivational interviewing, including engaging patients in the process of behavioral change:

> *My experience is then the only really good change really, really comes from them. They know what they need to change.* (Exercise Professional)

They explicitly touch upon empowerment, implying self-efficacy and autonomy:

> *The plan is education so that they can make decisions on a day-to-day basis. That they feel that they can make. Again, it is about being empowered.* (Exercise Professional)

Physicians also focus on what motivates patients to change their exercise behavior, but view their role in exercise behavior change primarily in goal setting:

I usually brainstorm with them about what [exercise] they might have...interest in...and discuss what their ultimate goal is and try to figure out a way to reach that goal. (Physician)

4. Barriers and Facilitators

What are barriers and facilitators to physicians writing exercise prescriptions/referrals?

4.1 Time

Thirty-eight percent (38%) of physicians cite "limited time" as a barrier to their writing exercise prescriptions/referrals, the second most cited barrier (see Table 2).

Table 2. Physicians' Perspectives on Barriers to Writing Exercise Prescriptions/Referrals (n=50)

Barrier	Percent of Physicians (%)
Lack of patient motivation	40
Limited time	38
Lack of reimbursement	22
Difficulty locating/nonexistent in medical record	16
Concerns about patient adherence	16
Lack of knowledge/skills	14
Lack of tools/materials	14
Lack of feedback loop back to physicians	14
Lack of exercise facilities/providers	12
Concerns for patient safety	6
Concerns about exercise professionals	4

Correlations were determined to understand whether one barrier to physicians writing exercise prescriptions/referrals was associated with another barrier. Lack of patient motivation and limited time appeared together in almost one quarter of the responses (24%). Patient adherence and feedback loop (r=.45), patient motivation and limited time (r=.37), patient

motivation and lack of reimbursement (r=.35), limited time and lack of facilities (r=.34), lack of facilities and medical record (r=.34), patient adherence and patient motivation (r=.31), patient adherence and lack of reimbursement (r=.30), and limited time and lack of reimbursement (r=.28) were statistically significant and most strongly correlated.

Physicians try to balance the short amount of time allocated to office visits with the long list of topics to discuss with patients when addressing barriers to writing exercise prescriptions/referrals:

> *And maybe we don't really have time to have a long conversation about exercise or weight loss. Even though it is really in the patient's best interest to do that.* (Physician)

Exercise professionals also point out lack of time as a barrier to physicians writing exercise prescriptions/referrals, referring to it as "heavy lifting" in the fifteen minutes they have with the patient.

4.2 Cost

Patients often raise cost concerns to physicians, which physicians then factor in when writing exercise prescriptions/referrals. Twenty-two percent (22%) of physicians specify "lack of reimbursement" as a barrier to their writing an exercise prescription or making an exercise referral.

Some physicians who find that cost is an issue for patients may propose local, affordable options. They specifically identify Planet Fitness as an inexpensive facility, and the $60 for 60 day program as a way to get patients into Health & Fitness Center O at a discounted price, even if they can not afford to sustain the membership after 60 days. Other physicians may steer clear of referring to health & fitness centers, because of patient cost concerns:

> *I am most often trying to find something that is affordable and that patients can incorporate into their busy lifestyle. They don't have to go to a gym to get fit. That is my message.* (Physician)

4.3 Training

Insufficient training serves as a barrier to physicians writing exercise prescriptions/referrals. In fact, 14% of physicians indicate "lack of knowledge/skills" as a barrier to their writing an exercise prescription or making an exercise referral.

The physicians surveyed acknowledge that they do not receive the training, either in medical school or in continuing medical education:

> *We don't learn about it, quite frankly, it is not part of our training. There is a dearth of information or recommendations from even the continuing ed.* (Physician)

When physicians do receive the training, they recognize its value. Specifically, they mention lifestyle medicine courses where they learned about exercise recommendations, the FITT (Frequency, Intensity, Time, Type) principle and behavior modification.

Exercise professionals also note physicians' lack of training, and the small number of classes on nutrition or exercise that physicians take in medical school compared to their own background and experience:

> *They touch on it, but we have four plus years of education, certifications, and everything.* (Exercise Professional)

4.4 Confidence

When asked about confidence level in providing an appropriate exercise prescription that includes type, frequency, intensity and duration of exercise, fifty-two percent (52%) of physicians are "very confident" or "moderately confident" in providing an appropriate exercise prescription with frequency and type of exercise. The comparable number for duration of

exercise is 49% of physicians. However, when it comes to intensity of exercise, only 36% of physicians are “very confident” or “moderately confident” in providing an appropriate exercise prescription.

Thirty-two percent (32%) of physicians are “slightly confident” or “not at all confident” in providing an appropriate exercise prescription with frequency and duration of exercise. Thirty-five percent (35%) are “slightly confident” or “not at all confident” in providing an appropriate exercise prescription with type of exercise. This number increases to 43% when it comes to intensity of exercise.

For all physicians, the mean confidence level in providing an appropriate exercise prescription with frequency of exercise was 3.32 (SD 1.47; 5=very confident; 1=not at all confident), type of exercise was 3.28 (SD 1.52), duration of exercise was 3.23 (SD 1.42) and intensity of exercise was 2.89 (SD 1.49) (See Figure 7). There was not a statistically significant difference (p=.44) in mean confidence level in providing an appropriate exercise prescription in type, frequency, duration or intensity of exercise.

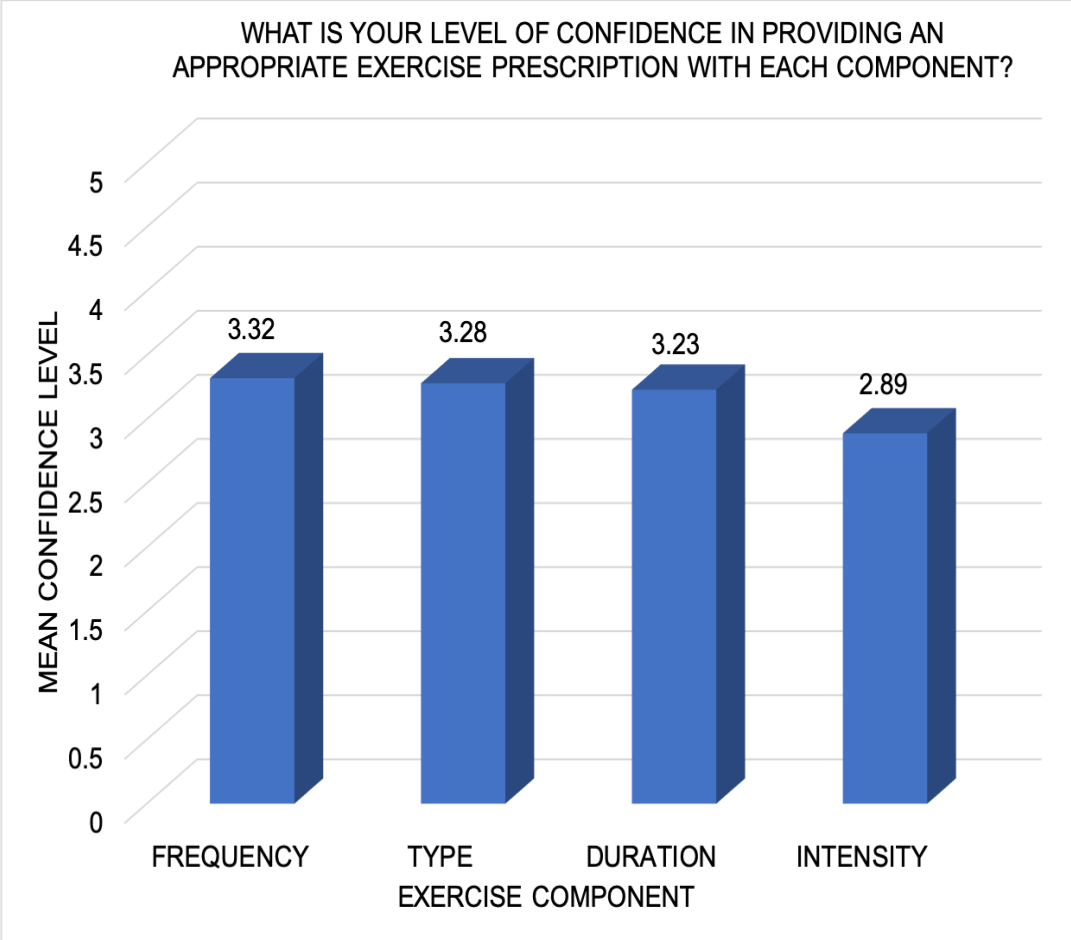

Figure 7. Physicians' Confidence Level in Providing Exercise Prescriptions By Exercise Component.

Low confidence can serve as a significant barrier to physicians writing exercise prescriptions/referrals:

> *There is a lot of...fear from the practitioner's point of view because when people don't know...about the healthy effects of exercise, or they don't know how much is too much, they tend to recommend none.* (Physician)

4.5 Electronic Medical Record Systems

Sixteen percent (16%) of physicians reveal "difficulty locating/nonexistent in medical record" as a barrier to their writing an exercise prescription/referral:

> *There is no template or Rx for exercise in the EMRs, so you can't really do that with…electronic medical record, there is no option. So that is a major barrier* (Physician)

The current electronic medical record system allows physicians to check a referral box to one of Health & Fitness Center O's four programs. In fact, physicians reported first learning about their ability to refer to Health & Fitness Center O at provider meetings on the electronic medical record system. In the current system, however, exercise professionals do not have the ability to provide results and receive information, which necessitates paper faxing.

Hospital AZ was transitioning to a new electronic medical record system in the weeks immediately following when the surveys and interviews were conducted. The new electronic medical record system will streamline the process, allowing physicians to see results in real time.

Physicians and exercise professionals alike see the potential of the electronic medical system to facilitate communication between the referring physician and the exercise professional working with the referred patient:

> *Making it easy to do electronically will be very nice.* (Physician)

> *It will be a lot easier to get those results to our physicians. Right now it is a bit of a paper, faxing, middleman process. So it will be a lot easier to get them there.* (Exercise Professional)

Exercise professionals were also optimistic about the potential role the electronic medical record system could play in increasing not only communication, but also trust, between physicians and exercise professionals.

> *Each appointment will have all of their metrics, all of their goals, the physicians will be able to see that real time...it just gives them the ability to have more trust in us. We are on the EMR, we are just like everybody else.* (Exercise Professional)

5. Trusted Health & Fitness Centers/Exercise Professionals

What are characteristics of health & fitness centers and exercise professionals that physicians would trust to refer their patients?

5.1 Physician Trust/Credibility

Physicians view discussing exercise with their patients as important, and a key part of their role as a physician:

> *I usually talk about exercise as medicine to all my patients, so every single one of my patients I recommend exercise to.* (Physician)

Physicians acknowledge the importance of being physically active themselves. They observe how their own personal experience with exercise prompts them to discuss exercise with their patients. They recognize the value of exercise for themselves and for their patients:

> *I am going to be more valuable to my patients if I have a better understanding and can talk to them about my own exercise program...I think it can be motivating.* (Physician)

Exercise professionals also recognize the value of a physically active physician, because it influences their likelihood of discussing exercise with their patients and referring their patients:

> *And, so we do have some physicians who really understand and are empowered to have their patients experience exercise as a part of their health and lifestyle management.* (Exercise Professional)

5.2 Health & Fitness Center Trust/Credibility

When asked about the characteristics of a health & fitness center that they would trust to refer their patients, physicians indicate that their personal familiarity with the center influences their likelihood of referral. Physicians cite the health & fitness center's infrastructure as

important, such as equipment that is safe, inclusive and meets the needs of their patients. Physicians also cite the accessibility of the health & fitness center, when accessibility includes convenience in terms of geographic proximity to their patients' home or work, the hours their patients are able to access the facility, and the price point at which their patients are able to access the facility. Finally, physicians mention the variety of programs and classes offered to their patients. Learning about the health & fitness center's location, hours of operation, equipment, affordability, programming and services reinforces physicians making exercise referrals.

In addition to personal familiarity, reputation and word-of-mouth are critical:

> *I think it is just from being in the community for some time, and hearing where all the patients go or where other docs go or...where they send their people afterwards.* (Physician)

Exercise professionals also place importance on physicians' personal familiarity, reputation and word-of-mouth helping facilitate exercise prescriptions/referrals, and building trust.

Physicians and exercise professionals alike recognize that a health & fitness center's affiliation with a healthcare system increases their confidence and trust:

> *I think one of the important aspects is if the fitness center is affiliated with the healthcare system, it makes me feel more confident about their skills.* (Physician)

> *It does help that we are now a department of the hospital...I think that gives them a little bit more trust.* (Exercise Professional)

5.3 Exercise Professional Trust/Credibility

When asked about the characteristics of an exercise professional that they would trust to refer their patients, physicians name their personal familiarity with the exercise professionals, in addition to their personal familiarity with the health & fitness centers, influencing likelihood of

referral. They want to know that the exercise professionals have the knowledge and skill to work with the different patient populations that physicians are referring to them.

Exercise professionals also report that physicians' personal familiarity with them influences confidence and trust:

> *Physicians want to know that [their patients] are exercising in a place where if anything bad or adverse were to happen, they are in good hands.* (Exercise Professional)

Physicians place importance on the knowledge and skill of exercise professionals, their baseline medical knowledge, and their experience working with special populations. These special populations include people with different injuries, disabilities, and diagnoses.

When exercise professionals speak of knowledge and skill, they specify education level—bachelor's degrees in exercise science or kinesiology, Master's degrees, and continuing education—as well as certifications (e.g., personal trainer, health coaching, special populations).

> *[M]aking sure physicians know we do have degrees on top of certifications.* (Exercise Professional)

When asked about their confidence level in helping a patient fill an exercise prescription/referral, ninety-one percent (91%) of exercise professionals are "very confident" (58%) or "moderately confident" (33%). For all exercise professionals, the mean confidence level in helping a patient fill an exercise prescription/referral was 4.42 (SD .90; 5=very confident; 1=not at all confident), almost midway between "very confident" and "moderately confident."

Despite relatively high confidence levels, 42% of exercise professionals assert that additional knowledge or training would increase their confidence in helping a patient fill an exercise prescription (see Figure 8). Seventeen percent (17%) say that a specialty certification would increase their confidence in helping a patient fill an exercise prescription.

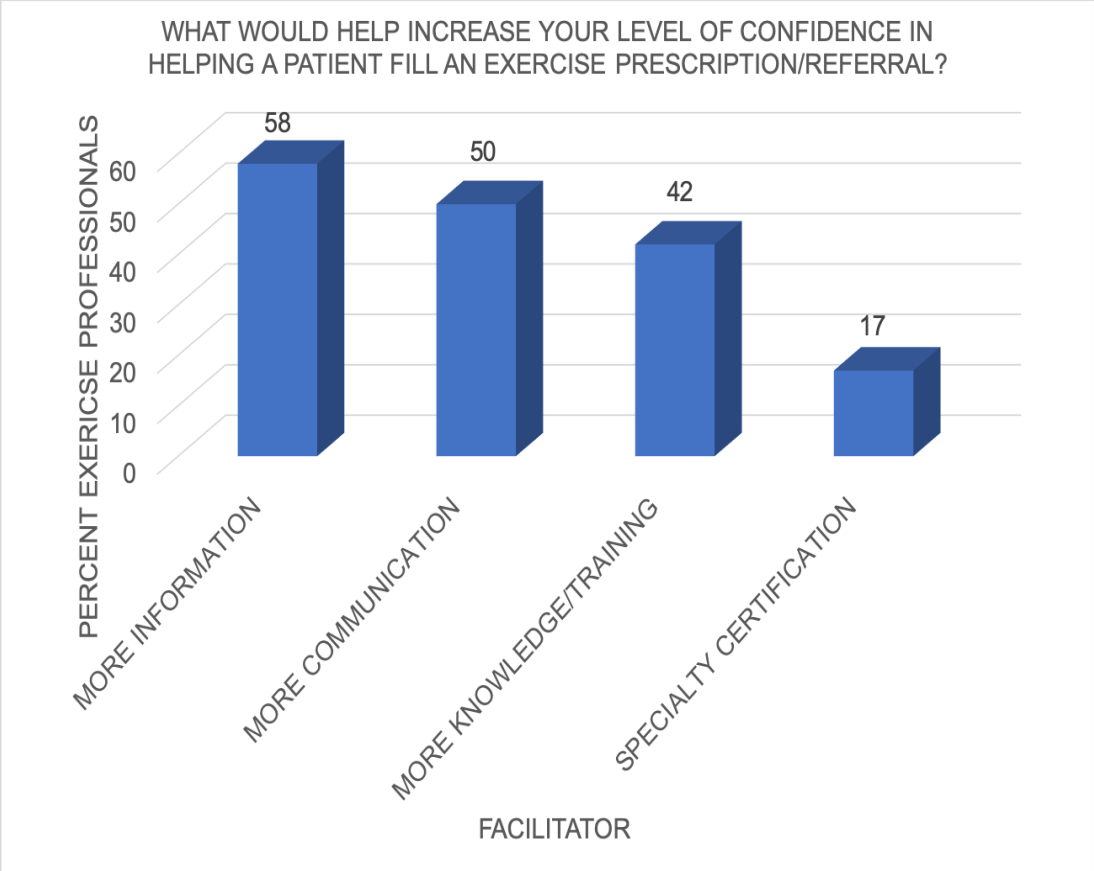

Figure 8. Exercise Professionals' Perspectives on Facilitators to Confidence in Helping Patients Fill Exercise Prescriptions/Referrals.

Physicians are much less likely than exercise professionals to draw a connection between knowledge and education and credentialing. This seems to be a function of the extent of physicians' understanding of exercise professional credentialing.

> *I certainly don't go searching out who is a certified trainer or who has any kind of credentialing or, I don't know the term I am looking for, but I know they all can get, not the equivalent of board certified, but there is some sort of certification they all achieve. I don't have any access to that kind of information. So I don't really know who is approved and who isn't.* (Physician)

Instead, physicians use other metrics as a proxy for knowledge and skill. They want to have confidence that the exercise professional will take good care of their patients and ensure that they do not get hurt.

Physicians also prize soft skills that are harder to quantify, such as empathy and compassion:

> *They would have to be someone who is compassionate for sure. That is the number one thing, I think. Because you have to meet people where they are.* (Physician)

Bottom-line, physicians want to know:

> *...how good the [exercise professional] is at their art and science of progressing people through exercise.* (Physician)

Exercise professionals also call out the importance of empathy and compassion:

> *[J]ust give the physician some confidence in us. And also that the people we hire are very compassionate. They have clinical experience. They also have experience working one-on-one with people and in group settings.* (Exercise Professional)

5.4 Collaboration and Communication

When physicians refer patients to exercise professionals, they sometimes provide just the referral without any documentation. Other times, they will provide significant documentation, such as the History & Physical Exam (H & P) for the patient. Fifty-eight (58%) of exercise professionals state that more specific information in the exercise prescription would increase their confidence in helping a patient fill the prescription, and half of exercise professionals state that more communication with the referring physician would increase their confidence (see Figure 8). When they speak about the "ideal referral," exercise professionals allude to the

physician's concerns and reasons for referring, the physician's goals for the patient, and the patient's medical limitations:

> *I also like getting all the medical information on the person, because it just helps us do a better job with them.* (Exercise Professional)

When exercise professionals report back to physicians about patients they referred, they provide information about pre- and post-screening results, such as anthropometric (e.g., weight, height, waist circumference), vital sign, and fitness assessments. They see this type of feedback as critical to informing physicians about the value of the referral, how their patients are progressing, and building trust.

It is equally as common for exercise professionals to "always" (25%) or "very often"(17%) provide feedback to the referring physician about their patients as it is for exercise professionals to "rarely" (25%) or "never" (17%) provide feedback. For all exercise professionals, the mean frequency of providing feedback to the referring physician about their patients was 3.08 (SD 1.51; 5=always; 1=never), or approximately "sometimes:"

Physicians value feedback from exercise professionals that measures and quantifies patients' progress. However, there seems to be a wide differential in the amount and quality of feedback that they receive from exercise professionals:

> *The communication is really excellent. We can send over referrals. And we get outcomes back.* (Physician)

Versus:

> *I don't get anything back, written or verbal or anything...it would be nice to hear if they were successful or not.* (Physician)

Often the patient plays an important role in connecting the clinical setting and the exercise facilities and professionals. Physicians tend to refer to exercise facilities and professionals where previously referred patients have reported back "good success." Exercise

professionals highlight the important role that patients play in facilitating communication and building physician trust:

> *If the patient feels...like I have done my best to meet them where they are at...then I have gained the trust of the patient. And that probably matters a lot more to me than the physician trusting me. Because I know the patient is going to go back to the physician...* (Exercise Professional)

Or, conversely, in eroding trust:

> *If the patient goes back and says I had a terrible experience, they didn't know they were doing, then we lose that trust with the physician.* (Exercise Professional)

6. Patient Exercise Behavior Change

What is the impact of physician exercise prescriptions/referrals on patient exercise behavior?

6.1 Uptake and Adherence - Patients Filling Exercise Prescriptions/Referrals

When asked to what extent their patients adhere to the written exercise prescriptions/referrals that they make, 28% of physicians respond "I don't know." Of the physicians who do know about patient adherence, 51% of physicians think that their patients adhere to the written exercise prescriptions/referrals that they make "very often" (6%) or "sometimes" (45%). Twenty-one percent (21%) of physicians think that their patients adhere to the written exercise prescriptions/referrals that they make "rarely" (19%) or "never" (2%) (See Figure 9). For all physicians, the mean response about adherence to written exercise prescriptions/referrals was 2.76 (SD .65; 5=always; 1=never), somewhere between "sometimes" and "rarely."

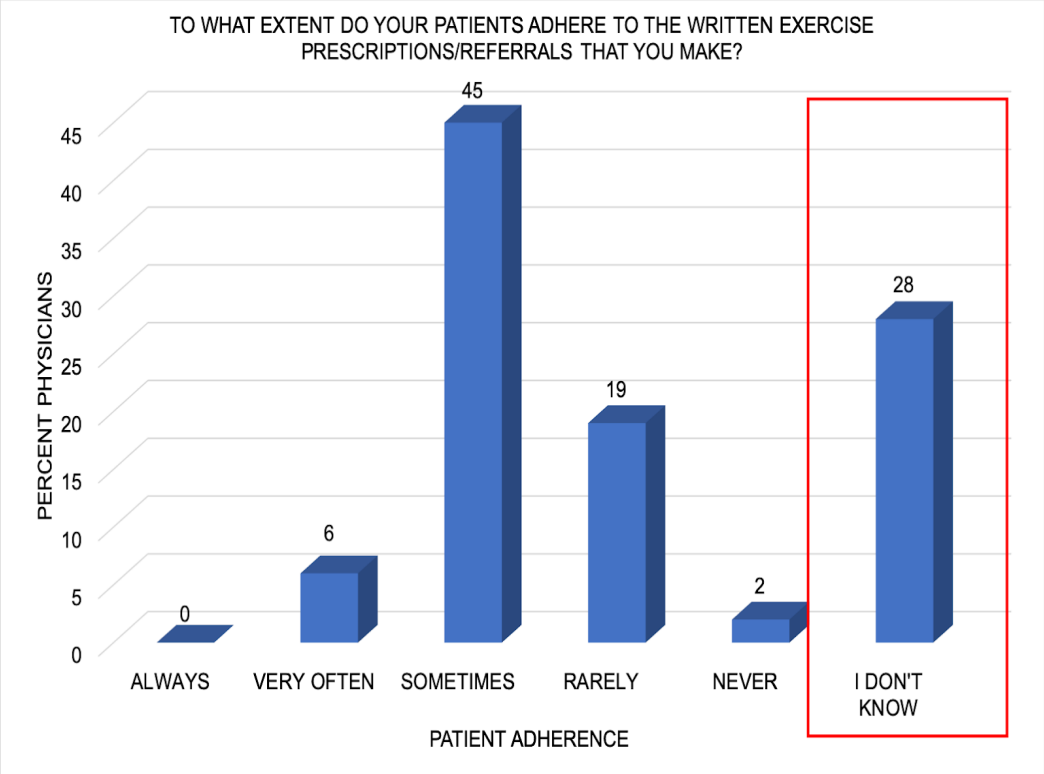

Figure 9. Physicians' Perspectives on Patient Adherence to Exercise Prescriptions/Referrals.

Comparing primary care physicians and specialists, 41% of specialists respond "I don't know" when asked to what extent their patients adhere to the written exercise prescriptions/referrals that they make. No primary care physicians respond "I don't know" when asked to what extent their patients adhere to the written exercise prescriptions/referrals that they make.

Seventy-nine percent (79%) of primary care physicians versus 41% of specialists think that their patients adhere to the written exercise prescriptions/referrals that they make "very often" or "sometimes." Twenty-one percent (21%) of primary care physicians versus 16% of specialists think that their patients adhere to the written exercise prescriptions/referrals that they make "rarely." No primary care physicians— and only one specialist—respond "never." For primary care physicians, the mean response about adherence to written exercise prescriptions/referrals was 2.79 (SD .43; 5=always; 1=never), and for specialists, the mean

response was also 2.79 (SD .79). There was no statistically significant difference between primary care physicians and specialists in the mean (p=.99) or median (p=.95) response about adherence.

Some physicians remark that they only receive feedback on patients who adhere to the exercise prescription/referral:

> *I think the people I get the feedback on are the people who are compliant. I think I don't get any feedback on the people who are not following through.* (Physician)

Other physicians remark that they only receive feedback on patients who do not adhere to the exercise prescription/referral:

> *The majority of feedback I receive is actually regarding the non-compliance of patients...basically they don't show up for their referral….I think it would be helpful if as a provider I am given feedback about their compliance and their progress during their enrollment.* (Physician)

Physicians acknowledge the barriers to patients filling exercise prescriptions/referrals:

> *They are much happier to get a prescription for medication than they are for me to recommend exercise.* (Physician)

They imply that patients who are resistant to taking medication are more likely to adhere to an exercise prescription/referral because they prefer it to the alternative:

> *I will say well, you know the one way to prevent me from adding one more pill or from starting a medicine is exercise.* (Physician)

Eighty-three percent (83%) of exercise professionals cite "limited time" as a barrier to patients filling exercise prescriptions/referrals—the most cited barrier—followed by "lack of patient motivation" (75%) (see Table 3).

Table 3. Exercise Professionals' Perspectives on Barriers to Patients Filling Exercise Prescriptions/Referrals (n=12)

Barrier	Percent of Exercise Professionals (%)
Limited time	83
Lack of patient motivation	75
Lack of knowledge/skills about how to fill the prescription	50
Lack of reimbursement	33
Lack of fitness facilities/providers	17
Lack of knowledge/skills about where to fill the prescription	8
Concerns about exercise professionals	0

Exercise professionals that work with patients referred into weight management programs, where visits with RDs are covered by insurance, specifically touch on cost as a barrier to patients filling exercise prescriptions/referrals:

> *For people who may only get three visits, or one visit, or their copay is really expensive, or they have got thousands of dollars before the deductible, cost is always a barrier* (Exercise Professional)

When discussing what serves as a facilitator to patients filling exercise prescriptions/referrals, exercise professionals identify the exercise prescription/referral itself as an incentive:

> *It gives the patient more incentive to start an exercise program if they were encouraged to do so as opposed to just joining a gym on their own.* (Exercise Professional)

Exercise professionals also feel that accountability—specifically, a follow-up appointment—is important:

> *As soon as the patient is referred, like within that day, or the next day, they need to be followed up on. They need to be called to set up their appointment. If you wait even a week, they are less likely to think it is a good idea. Even if their physician is telling them, you need to do this.* (Exercise Professional)

About 40% of patients that are referred to Health & Fitness Center O never enroll in a program, and Health & Fitness Center O carefully tracks the dropout and completion rates of those who do enroll. Thus, accountability continues through the duration of the program, with follow-up appointments with exercise professionals, health coaches and RDs, as well as the requirement that patients use the exercise facility eight times per month.

Physicians also highlight the importance of accountability, and often assess patient adherence to exercise prescriptions/referrals during follow-up appointments:

> *I think [an exercise prescription/referral] has a profound potential if people adhere to it. I just know which patients have been participating in exercises, they are the ones that have done well. They are enjoying life, and I can just see the outcomes.* (Physician)

Feedback from exercise professionals about the patients' progress allows the physicians to provide feedback to the patients, including positive reinforcement, during follow-up appointments:

> *Because when you get something back you can talk to your patients about it. Either say hey, you are falling short or good job.* (Physician)

6.2 Patient Exercise Behavior Change (Short- to Medium-term, Long-term)

When asked about the extent to which exercise prescriptions/referrals change patient exercise behavior, 92% of exercise professionals think that exercise prescriptions/referrals change patient exercise behavior "to a very great extent" (8%), "to a great extent" (42%) or "to a moderate extent" (42%). Only 8% of exercise professionals think that exercise prescriptions/referrals change patient exercise behavior "to a small extent" (8%) or "not at all" (0%) (See Figure 10). For all exercise professionals, the mean response about patient exercise behavior change was 3.5 (SD .80; 5=to a very great extent; 1=not at all), or halfway between "to a great extent" and "to a moderate extent."

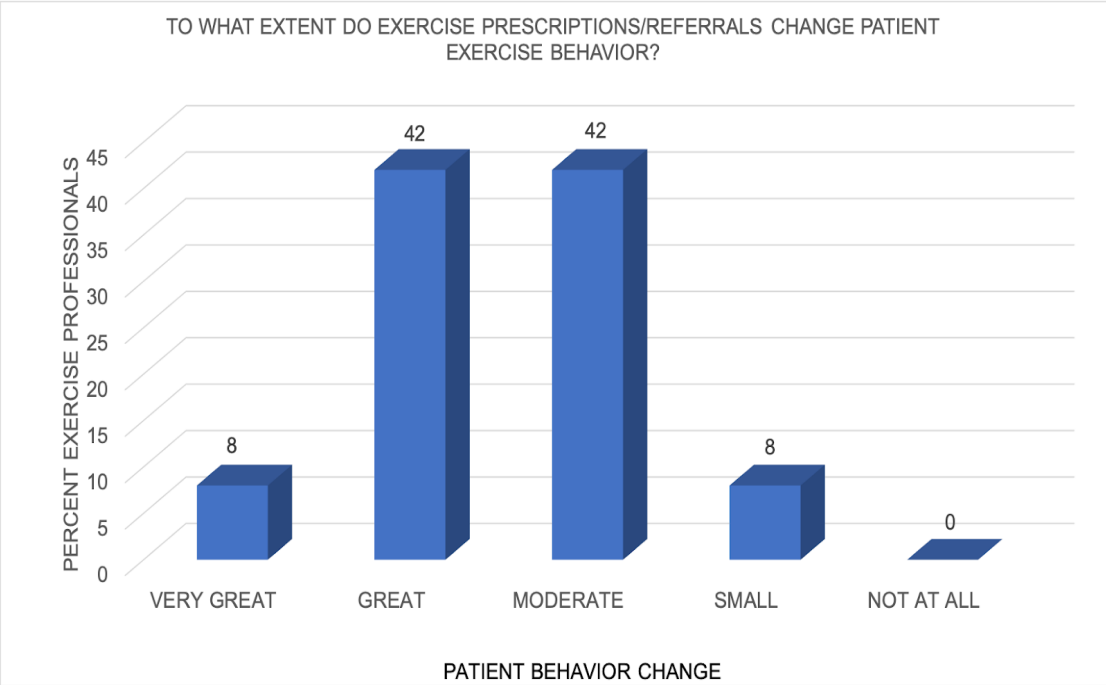

Figure 10. Exercise Professionals' Perspectives on Patient Exercise Behavior Change.

Exercise professionals use conversion to membership as a proxy for exercise behavior change:

> *Our best way of following up is if we have done a good job, if they have seen the value of our service and the value of our gym, and they choose to become a member.* (Exercise Professional)

Exercise professionals find that the value in exercise prescriptions/referrals lies in the message that it sends to patients about physicians' views of the role that exercise plays in their health:

> *I find it valuable that the physicians find exercise valuable and vital to success at maintaining overall health.* (Exercise Professional)

Just as many physicians respond "I don't know" when asked about patient adherence to exercise prescriptions/referrals, so, too, do they respond "I don't know" when asked about exercise behavior change on a longer-term basis.

Interviewer: What is your perception of how exercise prescriptions/referrals change patient exercise behavior?
Physician: I don't know. Do you know?

Physicians and exercise professionals alike recognize the importance of creating habits in longer-term exercise behavior change:

> *And then for another group of people, I think it is creating the habit of exercise. They want to do it, they seem interested in doing it, and then they come back and say, yeah, I just never started the habit, and so it never gets to be a regular thing.* (Physician)

> *And then those are the people that we end up seeing here a couple of months later. We see that they are still doing their own thing. We are passing them in the gym. And they are keeping up with their previously made habits.* (Exercise Professional)

Physicians and exercise professionals alike also recognize the importance of exercise becoming incorporated into the patient's daily life, for life:

> *I do everything I can to instill upon them that they need to continue exercising for life.* (Physician)

> *My goal for them is to make exercise enjoyable, to make it part of their everyday life. So it is not a prescription per se, it is part of their life. It is something that they need to do consistently until the day they die.* (Exercise Professional)

6.3 Social Support

Exercise professionals remark upon social support as an important facilitator to patients filling exercise prescriptions/referrals and changing exercise behavior. Specifically, they acknowledge the instrumental role that they play in helping patients achieve their goals:

> *They can come in and see us face-to-face, and [they] are the ones that do the best because they are held accountable, they are more engaged, there is more of a human aspect to the program.* (Exercise Professional)

They also refer to the patient's social support both within and outside the exercise facility:

> *We also talk about social support, too, communicating with your spouse or signing up for races or something like that to keep them moving* (Exercise Professional)

6.4 Technology/Self-Monitoring

Physicians and exercise professionals alike mention technology and self-monitoring as accountability tools that facilitate patients filling and adhering to exercise prescriptions/referrals, and patient exercise behavior change. Specifically, they name fitness and weight loss apps such as MyFitnessPal, Noom, Couch to 5K, as well as step-tracking devices, such as Fitbits and smartphones:

> *I find it shows that people are willing to take the time to look or to enter their data, so to me, it signifies that it is important to them.* (Exercise Professional)

IV. DISCUSSION

1. Applying a Social Ecological Lens to Exercise Prescriptions/Referrals

It is extremely difficult to change exercise behavior. New Year's Resolutions are a testament to that phenomenon, with "exercising more" the most common resolution made by 13% of Americans (Poon, 2019, para. 2). While it is true that Americans' physical activity levels are up 34% during the first week of January, they drop precipitously by the third Thursday of January (Poon, 2019). In order to change exercise behavior for longer than three weeks, a person needs to be motivated, and to believe that she can change her behavior. These are individual factors that influence exercise behavior.

Importantly, this study revealed that exercise behavior is also shaped by factors beyond the individual (see Figure 11). Exercise prescriptions/referrals, by their very nature, involve the relationship between the individual and interpersonal factors beyond the individual. A physician counsels a patient to change her exercise behavior, and the patient listens to her because she is a trusted provider, a physically active role model and/or a credible source of physical activity information. Physicians and exercise professionals can even influence the individual levels of motivation. Physicians and patients agree, through the exercise prescription/referral, that the patient is motivated enough to change exercise behavior. Exercise professionals provide the patients with the social support and accountability they need to follow through on the exercise prescription/referral.

Many of the barriers to physicians writing exercise prescriptions/referrals are organizational factors that exist beyond the individual. These organizational factors include limited time during the office visit or lack of a mechanism to refill exercise prescriptions/referrals. Many of the facilitators to physicians writing exercise prescriptions/referrals are also due to

organizational factors beyond the individual, such as an electronic medical record system that supports referrals and feedback from the exercise professionals to the physicians.

Exercise prescriptions/referrals also connect the individual and community factors beyond the individual. Physicians can provide patients with personalized exercise prescriptions with dosage information, to be filled at home or in a community-based facility. They refer patients to community-based health & fitness centers that they trust will be accessible to their patients. They refer patients to community-based exercise professionals that they trust will be knowledgeable and compassionate. However, physicians are significantly more comfortable referring patients to a health & fitness center that is not community-based, but instead, hospital-affiliated and part of the same organization.

Finally, exercise prescriptions/referrals concern the interplay between the individual and policy/environmental factors. Physicians may not write an exercise prescription/referral for a patient because of concerns about costs to the patient or may be more likely to refer a patient to a physical therapist than an exercise professional because it is covered by insurance. Alternatively, physicians may have insufficient training to write exercise prescriptions/referrals because it is not required in medical school or continuing medical education. Project success —increasing the number of U.S. physicians who write exercise prescriptions/referrals or the types of community-based health & fitness centers that physicians trust to refer their patients—requires applying a broad social ecological lens focused on the interrelationship between individual, interpersonal, organizational, community and policy/environmental factors.

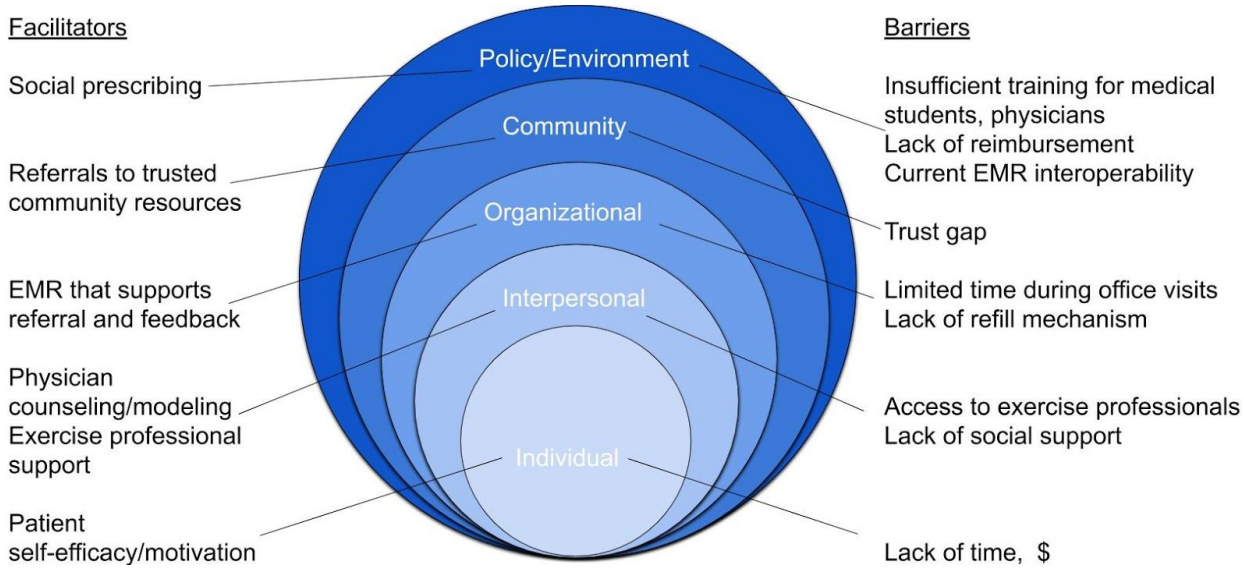

Figure 11. Exercise Prescriptions/Referrals Through a Social Ecological Lens. Adapted from "An ecology perspective on health promotion programs" (McLeroy et al., 1988).

2. Recommendations

2.1 10 Steps Hospital AZ Can Take to Address Barriers to Physicians Writing Exercise Prescriptions/Referrals

Collecting and analyzing the data generated 10 recommendations for Hospital AZ to implement. There are four categories: communication/collaboration, training, tools/technology, and education/information. If Hospital AZ implements these recommendations, the healthcare organization will take steps toward addressing the barriers to physicians writing exercise prescriptions/referrals identified in this study.

1) Facilitate communication between the physicians and exercise professionals (communication/collaboration)

When asked to what extent their patients adhere to the written exercise prescriptions/referrals that they make, 28% of Hospital AZ physicians respond "I don't

know." Fifty percent of Health & Fitness Center O exercise professionals state that more communication with the referring physician would facilitate their helping patients fill exercise prescriptions/referrals. The new electronic medical record system has the potential to support more information exchange between physicians and exercise professionals to increase patient adherence.

2) Deploy care team members to share responsibility on physical activity counseling, prescription and referral (communication/collaboration)

   Thirty-eight percent (38%) of Hospital AZ physicians cite "limited time" as a barrier to their writing exercise prescriptions/referrals. There may be an opportunity for physicians to more closely collaborate with care team members on exercise prescriptions/referrals. A relevant model is the GRx exercise prescription/referral program in New Zealand, where physicians delegate exercise prescriptions/referrals to practice nurses and activity choice to exercise professionals.

3) Hold continuing medical education trainings on writing exercise prescriptions/referrals (training)

   Half of Hospital AZ physicians provide exercise prescriptions/referrals "very often" or "sometimes," and half provide exercise prescriptions/referrals "rarely" or "never." Fourteen percent (14%) of indicate "lack of knowledge/skills" as a barrier to their writing exercise prescriptions/referrals. There is physician appetite for learning more about writing exercise prescriptions/referrals, with a recognition that their previous training was valuable but may have been insufficient.

4) Hold peer-to-peer trainings by repeat referrers (training)

   Hospital AZ physicians identify their personal familiarity with a health & fitness center as influencing their likelihood of referral. There are a number of physicians who have

personal familiarity with the programs and services provided at Health & Fitness Center O and community-based exercise facilities. They tend to be repeat referrers and can share their knowledge and experience with other physicians.

5) Provide tools for writing exercise prescriptions/referrals (tools/technology)

   Sixteen percent (16%) of Hospital AZ physicians name "difficulty locating/nonexistent in medical record" and 14% name "lack of tools/materials" as a barrier to their writing exercise prescriptions/referrals. They specify certain tools and technology that would facilitate their writing exercise prescriptions/referrals. In particular, they mention prescription pads, pre-printed handouts, and templates in the electronic medical record system that they could select and have printed for patients to pick up at the front desk.

6) Automate exercise behavior questions prompting written exercise prescriptions/referrals (tools/technology)

   Only 30% of Hospital AZ physicians note "I established the patient was not exercising regularly" as a risk factor/condition prompting them to write exercise prescriptions/referrals. The new electronic medical record system has the potential to support more exercise prescriptions/referrals. A relevant model is Kaiser Permanente, where a medical assistant takes an exercise vital sign on every patient at every visit, which is then displayed in the vital sign header for the physician.

7) Implement a mechanism for refilling prescriptions into the exercise prescription/referral system (tools/technology)

   Hospital AZ does not have a formal mechanism for refilling exercise prescriptions/referrals. There is an opportunity for Hospital AZ physicians to issue another exercise prescription/referral if the patient has not yet achieved her exercise goals. A relevant model is again the GRx program, where there is a process for refilling

exercise prescriptions/referrals once a patient's progress is reported back to the referring physician.

8) Use patient testimonials and meet-the-trainers to raise Hospital AZ physicians' awareness of Health & Fitness Center O's exercise professionals' capabilities (education/information)

   Hospital AZ physicians acknowledge that they tend to refer to exercise facilities and professionals where previously referred patients have reported back good success and where they have personal familiarity. Health & Fitness Center O's exercise professionals take the time to raise awareness of its programs among physicians at provider meetings and health fairs. There may be an opportunity to incorporate more patient testimonials and orchestrate more meet-the-trainer time in those settings.

9) Compile informational handouts on community-based exercise facilities (education/information)

   A number of Hospital AZ physicians take the time to learn about community-based exercise facilities on their own. Knowledge of a health & fitness center's location, hours of operation, equipment, affordability, programming and services reinforces their writing exercise prescriptions/referrals because they are trying to match the patients' needs with the offerings. There may be an opportunity for Hospital AZ to provide all physicians with information on community-based facilities that would facilitate exercise prescriptions/referrals and save them time.

10) Provide informational handouts on home-based exercise for a range of conditions (education/information)

    A number of Hospital AZ physicians take the time to compile information on exercises for different patient populations on their own or with the help of their care team. Yet only 22% of physicians provide patients with a personalized exercise prescription with dosage

information, to be filled at home. There may be an opportunity for Hospital AZ to provide all physicians with materials that would save them time and facilitate exercise prescriptions/referrals.

2.2 10 Steps Toward Being a Health & Fitness Center That Physicians Trust to Refer Their Patients

Collecting and analyzing the data generated 10 recommendations for health & fitness centers to implement. There are three categories: communication/collaboration, education/information, and training. If health & fitness centers follow this roadmap, they will take steps toward becoming facilities that physicians would trust to take good care of their patients and help them achieve their health & fitness goals.

1) Provide feedback to physicians on patients' progress and outcomes (communication/collaboration)

When asked to what extent their patients adhere to the written exercise prescriptions/referrals that they make, 28% of physicians respond "I don't know." They want to know their patients are successful and tend to refer to facilities where previously referred patients have reported back good success. There is an opportunity for health & fitness centers to ensure that their exercise professionals are providing feedback that measures and quantifies patients' progress.

If they start seeing the outcomes sent back to them, and their patients are continually getting better, losing weight, have less pain, that starts building trust with them (Exercise Professional)

2) Reframe working with exercise professionals as a time-saver for physicians (communication/collaboration)

Physicians are pressed for time, and 38% mention “limited time” as a barrier to their writing exercise prescriptions/referrals. They could refer their patients to exercise professionals to develop an exercise program/plan for them. There is an opportunity for health & fitness centers to persuade physicians their exercise professionals are saving them hours spent compiling informational handouts and taking continuing medical education training.

[Physicians] don’t have enough time in their office visit to really do an assessment, to find out what exercise their patients need. (Exercise Professional)

3) Reframe exercise prescription/referral as a cost-saver for patients (communication/collaboration)

Physicians factor in patient cost concerns, and 22% mention that “lack of reimbursement” is a barrier to their writing exercise prescriptions/referrals. At the same time, they recognize that surgeries and medications can be more expensive than lifestyle management. There is an opportunity for health & fitness centers to persuade physicians that exercise prescriptions/referrals can save their patients money.

But if you consider the cost of medications and other healthcare-related costs, I think exercise programs are on the cheap side (Physician)

4) Explore partnering with physical therapy (communication/collaboration)

Physicians are more comfortable referring to hospital-affiliated health & fitness centers than community-based health & fitness centers. They also indicate they may be more likely to refer to physical therapy because it is covered by insurance. There is an opportunity for health & fitness centers to explore partnering with physical therapy to

secure a pipeline of new members transitioning from physical therapy to regular exercise programs.

Sometimes what I will do is try to tie in their physical therapy evaluation and treatment with the ultimate goal of having them transition to their health club. (Physician)

5) Leverage members to be ambassadors to their physicians (education/information)

Patients play a very important role in building trust between their physicians and health & fitness centers. There is an opportunity for health & fitness centers to recognize and leverage that role, encouraging members to report back on their progress. Members acting as ambassadors to their physicians encourages referrals of other patients.

If they had a good experience, they go back and talk to the physicians, and say, this is a great program, I felt so comforted, I knew exactly what I was doing, I made progress. Then their physicians are more likely to send to us. (Exercise Professional)

6) Invite physicians to frequent the facility (education/information)

Physically active physicians serve as role models for their patients. They mention how their own personal familiarity with a health & fitness center makes them more credible with their patients, and influences their likelihood of referral. There is an opportunity for health & fitness centers to increase physicians' personal familiarity with their facilities.

It is helpful if you have actually been into the club and you know where the machines are. I can talk to them about, yeah go upstairs and go into that group of machines and it is the third machine. So, patients like that, that you are familiar with it. (Physician)

7) Invite physicians to work with exercise professionals (education/information)

Physicians observe how their own personal familiarity with exercise professionals also influences their likelihood of referral. They want to know that exercise professionals have experience working with special populations, such as people with different injuries,

disabilities, and diagnoses. There is an opportunity for health & fitness centers to increase physicians' personal familiarity with their exercise professionals.

Ideally, I have personal interaction with them. I know what they do...and I know that they are going to have some knowledge of the conditions that patients have that I am sending to them. (Physician)

8) Raise physicians' awareness of exercise professionals' capabilities (education/information)

Exercise professionals equate education and certifications with experience and knowledge. But physicians prioritize other metrics as a proxy for experience and knowledge because they do not understand exercise professional credentialing. There is an opportunity for health & fitness centers to increase physicians' knowledge of their exercise professionals' capabilities in working with different types of patient populations to change their exercise behavior.

I don't think I have enough understanding of what it takes to be a credentialed trainer, so I don't know that that would sway me as much as just somebody who was a good motivator for exercise (Physician)

9) Raise physicians' awareness of the facility's infrastructure (education/information)

Physicians note the importance of a health & fitness center's infrastructure, such as equipment that is safe, inclusive and meets the needs of their patients. They also cite its accessibility (e.g., convenience, hours, price). There is an opportunity for health & fitness centers to increase physicians' knowledge of the facility's location, hours of operation, equipment, affordability, programming and services as a good fit for their patients.

And so then they have the opportunity to use different equipment, and the classes, and they have a swimming pool there, so it is a great way to get people into a program and then they can decide what equipment they like. (Physician)

10) Facilitate peer-to-peer physician trainings with repeat referrers (training)

Physicians who have personal familiarity with a facility have the potential to become champions for the facility. They are also more likely to become repeat referrers. There is an opportunity for health & fitness centers to create opportunities where physicians can share their experiences referring patients with other physicians.

They started getting a couple physician champions on board that they noticed would come to the facility, and then those physicians would trust in us and get the word out to other physicians. (Exercise Professional)

3. Strengths and Limitations

One strength of this study was that the study site included both a closed loop system in the clinical setting and an open loop system connecting the clinical setting and the community setting. In other words, in the closed loop system, physicians provide exercise referrals to a hospital-affiliated health & fitness center and receive feedback from hospital-affiliated exercise professionals. In the open loop system, physicians provide exercise prescriptions/referrals for patients to fill in a home-based or community-based setting. The ability to interview physicians who refer to both hospital-affiliated and community-based exercise facilities and professionals allowed for a more robust discussion about trusted health & fitness centers and exercise professionals. This was an important contributor to the generation of ten steps health & fitness centers can take to become community resources that physicians would trust to refer their patients.

This strength could also be seen as a limitation, however, because the type of exercise referral network found at Hospital AZ is relatively rare. This could limit the generalizability of the

results. Another factor limiting the generalizability of the results was the lack of diversity in the patient population, which is primarily white, middle income, and working age.

An additional strength of this study was that the study participants included primary care physicians and specialists. This allowed a comparison of primary care physicians and specialists in best practices for writing exercise prescriptions/referrals, which is particularly important for fields like physiatry and orthopedics. However, it also included fields like radiology and anesthesiology, which was a limiting factor because it could skew the results by, for example, inflating the percentage of physicians “rarely” or “never” writing exercise prescriptions/referrals.

Another limitation of this study was that physicians opted in to the surveys and interviews. This could result in selection bias, with a small sample of physicians who are especially interested in exercise.

V. CONCLUSION

1. Patient Behavior Change

The literature shows that, on a population level, getting more people more physically active would save lives. If all the people in the world who are physically inactive (i.e., failing to meet internationally recommended physical activity guidelines) were to become physically active (i.e., meeting the guidelines), 5.3 million premature deaths could be averted every year, increasing the life expectancy of the world's population by .68 (.41 to .95) years. (Lee et al., 2012). If physical inactivity were to be decreased by 10% or 25%, 533,000 or 1.3 million premature deaths, respectively, could be averted every year (Lee et al., 2012). Achieving the internationally recommended physical activity guidelines is associated with a 20-30% risk reduction in all-cause mortality compared with sedentary individuals (Lee & Skerrett, 2001).

In addition, the literature shows the number of people needed to treat (NNT) for one person to achieve and sustain the internationally recommended adult physical activity guidelines. For physical activity counseling or exercise prescriptions/referrals delivered in the clinical setting, the NNT is between 10 and 18 (Elley et al., 2004; Harrison et al., 2004; Orrow, Kinmonth, Sanderson, & Sutton, 2012; Williams, 2009). With an NNT of between 10 and 18, exercise prescriptions/referrals must be used widely to see improvements on a population level. Imagine if 100% of the 209,000 practicing primary care physicians in the United States delivered physical activity counseling or exercise prescriptions/referrals in the clinical setting to the 117.7 million U.S. adults who both see a healthcare professional annually and fail to meet the physical activity guidelines for either aerobic or strength training activities, exercise prescriptions/referrals have the potential to get between 4.8 million and 8.8 million U.S. adults physically active (i.e.,

meeting the guidelines) (Agency for Healthcare Research & Quality [AHRQ], 2018; Blackwell & Clarke, 2018; CDC, 2017; U.S. Census Bureau, 2010).

This doctoral project focused on physicians' and exercise professionals' perspectives on patient exercise behavior change but was unable to explore patients' perspectives on their own exercise behavior change. "Lack of patient motivation" is the barrier most often cited by physicians to writing exercise prescriptions/referrals. If physicians are not writing exercise prescriptions/referrals because they believe that patients are not motivated to follow through on them, without any evidence to the contrary, the underprescription of exercise will remain the norm.

Thus, future research should include collecting quantitative and qualitative data from patients to assess the impact of exercise prescriptions/referrals on patient exercise behavior and health outcomes. This doctoral project found that 28% of physicians don't know if their patients adhere to the exercise prescriptions/referrals that they make. Therefore, physicians' perspectives provide only a partial story. There needs to be an expanded evidence base on what happens after a patient receives an exercise prescription/referral, how effective exercise prescriptions/referrals are in changing patient exercise behavior, particularly in the long-term, and how effective they are compared with counseling alone.

2. Physician/Healthcare Organization Behavior Change

Realizing the potential of the clinical setting to influence population-level physical activity will require not only patient behavior change, but also change at the level of the individual physician or the healthcare organization.

2.1 Saving Physicians Time

The literature reveals that insufficient time is a significant barrier to physicians providing physical activity counseling or exercise prescriptions/referrals (Hébert et al., 2012). This doctoral project also revealed that "lack of time" is the second most cited barrier to physicians writing exercise prescriptions/referrals.

Physicians are increasingly pressed for time, and time pressures are the most cited factor contributing to physician burnout (Kelly, 2016). U.S. physicians experience burnout at twice the rate of the general U.S. working population (Shanafelt et al., 2015). A recent study shone a light on physician burnout as an economic problem costing the U.S. healthcare system $4.6 billion per year, or $7,600 per employed physician per year (Han et al., 2019). It behooves healthcare organizations to address physician time pressures and burnout, which is bad for employees, and bad for business.

Although addressing time pressures as a contributing factor to physician burnout is beyond the scope of this doctoral project, addressing "lack of time" as a barrier to physicians writing exercise prescriptions/referrals is a theme woven throughout the ten recommendations generated for Hospital AZ. The ten recommendations include closer collaboration with care team members, such as nurses, medical assistants and exercise professionals, on taking exercise vital signs, writing prescriptions/referrals and discussing activity choice. The ten recommendations also include implementing tools, templates, and technology in the clinical setting that can automate, prepopulate and preprint exercise prescriptions/referrals.

2.2 Social Prescribing

Social prescribing links primary care patients with sources of support in the community to improve their health and well-being (Bickerdike, Booth, Wilson, Farley, & Wright, 2016). Social prescribing is not a new concept: the U.K. Department of Health began advocating for social prescriptions for long-term conditions in 2006, with explicit mention of exercise prescriptions/referrals (Great Britain Department of Health, 2006); food was prescribed by physicians and filled at local grocery stores in the Mississippi Delta as early as the 1960s (Smith, 2014). The model for social prescribing in the clinical setting involves screening patients for social needs, referring patients to community-based organizations, and supporting patient access to social services (Alderwick, Gottlieb, Fichtenberg, & Adler, 2018). In addition to exercise, U.S. physicians are now prescribing nature (e.g., ParkRx), food (e.g., Food Rx), housing, and even poetry (Goddu, Roberson, Raffel, Chin, & Peek, 2015; Institute at the Golden Gate, 2019; Reddy, 2019).

As the U.S. healthcare system moves toward value-based care, healthcare organizations are increasingly investing in their communities and aligning with community-based organizations to address social needs and social determinants of health (Koh et al., 2019). For example, Kaiser Permanente made headlines in 2018 with its $200 million commitment and partnership with Enterprise Community Partners to invest in affordable housing (Abrams, 2019). ProMedica began screening for food insecurity in 2013 and patients are able to fill food prescriptions at a food pharmacy or nonprofit grocery store (Oostra, Zuckerman, & Parker, 2018). There may be an opportunity to frame exercise prescription/referral within these social determinants of health and social prescribing movements, as part of a larger discussion about connecting healthcare to community-based resources to improve population health.

3. Connecting the Clinical and Community Settings

Realizing the potential of the clinical setting to influence population-level physical activity will require connecting the clinical setting and the community setting. This reflects the growing recognition that clinical care accounts for only 20% of the modifiable determinants of health (Hood, Gennuso, Swain, & Catlin, 2016).

3.1 Facilitating Collaboration Between Physicians and Exercise Facilities/Professionals

The literature confirms there is value placed on collaboration between physicians and community-based exercise facilities/professionals, as patients that follow through on exercise prescriptions/referrals with ongoing support from community-based exercise professionals integrate exercise into their daily lives outside the clinical setting (Leemrijse, et al., 2015; Patel et al., 2011).

This doctoral project was conducted in an exercise referral network where physicians can refer patients to a hospital-affiliated health & fitness center, a community-based health & fitness center not affiliated with a hospital or clinic, an independent exercise professional, or a home setting. This allowed for an exploration of physicians' perspectives on referrals to hospital-based versus community-based exercise facilities/professionals. The results demonstrated marked differences in physicians' referral practices and mean comfort level in referring to hospital-based versus community-based health & fitness centers (See Figure 12).

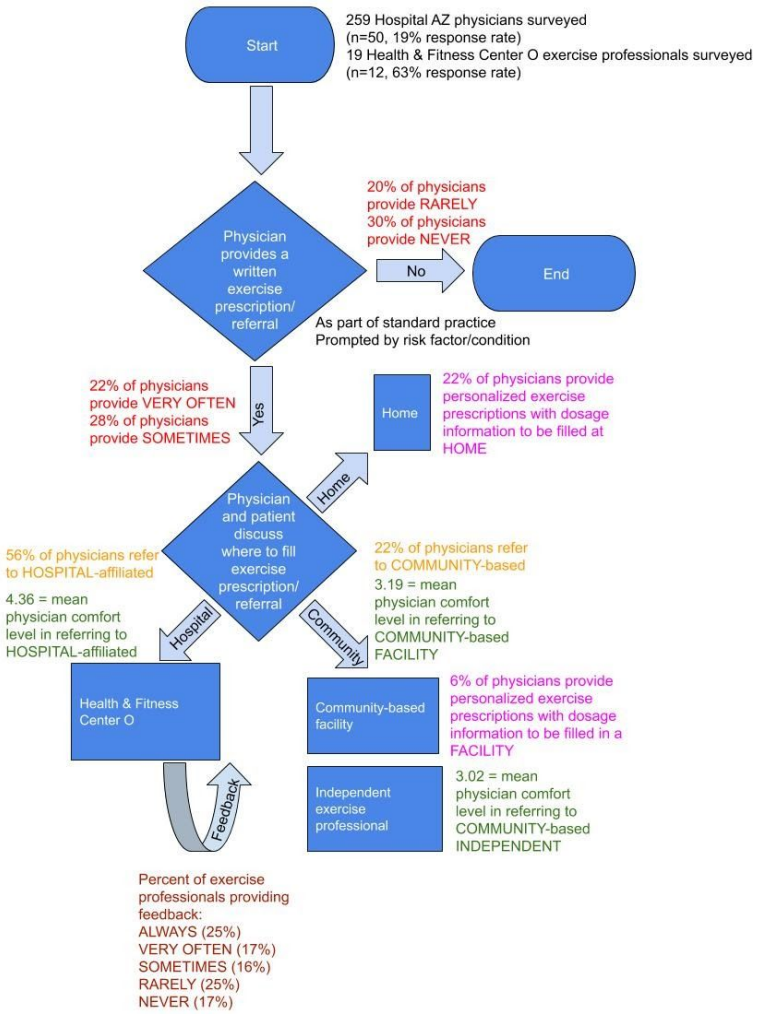

Figure 12. Exercise Prescription/Referral Pathway.

The emergent theme of the trust gap between healthcare and community-based health & fitness centers—essentially, this differential in physicians' referral practices and comfort level—was the impetus for the ten steps for health & fitness centers. Raising physician familiarity with, awareness of, and confidence in community-based exercise/professionals builds physician trust in the ability of these facilities/professionals to provide good care for their patients.

3.2 Clarity in Language and Roles

The literature conveys a notable lack of clarity around the language of "exercise," "prescriptions," and "referrals." There has been a shift from an exercise-fitness paradigm to a physical activity-health paradigm, which is not reflected in the term "exercise prescription" (Haskell, 1994). Moreover, there is a lot of country-by-country variation in the terminology used for exercise prescriptions/referrals. Accordingly, there are suggestions that exercise prescriptions be standardized and renamed physical activity prescriptions to reflect the emphasis on broader physical activity promotion rather than its subset, exercise (Caspersen, Powell, & Christenson, 1985; Dugdill et al., 2005).

In addition, the literature highlights the lack of clarity around the differences between counseling, prescribing and referring, both in terms of language and roles. Many physicians think they are prescribing exercise when they tell their patients to "exercise more" (Seth, 2014, p. 12). Many physicians do not think they have adequate training to prescribe exercise, and would rather refer to someone else to prescribe (Persson et al., 2013).

This doctoral project also revealed a lack of clarity around the differences between counseling, prescribing and referring, both in terms of language and roles. Many physicians give verbal or written advice about physical activity, but do not necessarily view that advice as an "exercise prescription." In addition, many physicians provide patients with written handouts with exercise instructions or include exercise instructions as part of the patient plan for the office visit but may not view it as an "exercise prescription."

There is a disconnect between what physicians term "exercise prescription," and what exercise professionals term "exercise prescription." Exercise professionals report that what they receive from physicians rarely has much specificity beyond frequency and, perhaps, type; nor

do they consider it a prescription. Rather, exercise professionals consider what they receive from the physician to be a referral, and the program or plan they design for the patient the prescription. In many cases, exercise professionals strongly feel that it is their job to prescribe exercise; if physicians have sufficient trust in them and recognize the role that they can play in facilitating change in their patients, physicians will leave the exercise prescription to them.

On one hand, the resemblance between exercise and medication prescriptions and the use of the term "prescription" in the literature has been very effective in equating exercise with medicine. On the other hand, it has also led to a fair amount of confusion. The 2018 Physical Activity Guidelines Advisory Committee Scientific Report focuses on exercise prescriptions, specifically excluding interventions where primary care serves only as a referral source (HHS, 2018a). The WHO Global Action Plan on Physical Activity 2018-2030 (2018a) mentions both exercise prescriptions and referrals, specifically including, when appropriate or needed, referrals to community-based opportunities for physical activity. There needs to be clarity of language and roles in order to understand precisely what U.S. physicians should do in the clinical setting—prescribe or refer or both?—to get more people more physically active.

4. System/Policy Change

Realizing the potential of the clinical setting to influence population-level physical activity will require broad system/policy change, in the form of federal and/or state legislation, regulatory reform, and/or voluntary efforts within the healthcare system itself.

4.1 Training Physicians

The literature indicates that inadequate training in medical education—undergraduate, graduate and continuing—is a barrier to physicians writing exercise prescriptions/referrals (Cardinal et al., 2015). It also indicates that training in physical activity counseling, motivational

interviewing and exercise prescription/referral increases physicians' confidence in writing exercise prescriptions/referrals and the number of physicians doing so (Fowles et al., 2018).

This doctoral project found that "lack of knowledge/skills" is a barrier to physicians writing exercise prescriptions/referrals. About one-third of physicians surveyed are "slightly confident" or "not at all confident" in providing an appropriate exercise prescription with frequency, intensity, type and duration of exercise. In contrast, 91% of exercise professionals are "very confident" or "moderately confident" in helping patients fill exercise prescriptions/referrals that include frequency, intensity, type and duration of exercise.

In 2014, the Bipartisan Policy Center issued a white paper recommending that nutrition and physical activity training be incorporated into medical school curricula, residency programs, credentialing and licensing exams, and continuing medical education (Glickman et al., 2014). The ENRICH Act, a bill that would establish a grants program to integrate nutrition and physical activity into medical school curricula, was first introduced in the 113th Congress in 2014 and most recently re-introduced in the 116th Congress in 2019 ("H.R. 1888: ENRICH Act," n.d.). A number of states and the District of Columbia have also considered legislation mandating nutrition and physical activity continuing education for physicians (Milloy, 2019; "SB 380 - Continuing medical education," 2011).

Addressing the problem of inadequate training as a barrier to physicians writing exercise prescriptions/referrals requires healthcare organization-level behavior change and was included in the ten recommendations generated for Hospital AZ during this doctoral project. In addition to healthcare organizations supporting training for its residents and physicians, there will also need to be broader system/policy change to support training for medical students before they are affiliated with healthcare organizations. Clarity of language and roles around exercise prescription versus referral will contribute to an understanding of how U.S. medical students,

residents and physicians should be trained—in prescription or referral or both?—to get more people more physically active.

4.2 Healthcare Costs/Reimbursement

The literature shows that, on a population level, getting more people more physically active would save money. The annual global economic burden of physical inactivity is $68 billion, $28 billion for the United States (Ding et al., 2016). Although the majority is borne by governments and businesses in the form of healthcare expenses and lost productivity, a physically active American who does meet the U.S. physical activity guidelines pays, on average, $2,500 less per year in out-of-pocket healthcare expenses compared with an American who does not meet the U.S. physical activity guidelines (Valero-Elizondo et al., 2016).

In addition, the literature shows that there is evidence for the cost-effectiveness of physical activity interventions. (Abu-Omar et al., 2017). Specifically, exercise prescription/referral in the primary care setting is a "best buy," or better value for money, compared with usual care control groups (Dalziel, Segal, & Elley, 2006; Elley et al., 2004; MacAuley, Bauman, & Frémont, 2016, p. 1).

This doctoral project shows that 22% of physicians specify "lack of reimbursement" and patient cost concerns as a barrier to their writing an exercise prescription or making an exercise referral. The current universe of reimbursement for exercise prescriptions/referrals consists of inclusion of physical activity counseling to patients with cardiovascular disease risk factors, obesity, and abnormal glucose levels—as a United States Preventive Services Task Force (USPSTF) B-rated preventive service—in private plans, exchange plans and expanded Medicaid under the Patient Protection and Affordable Care Act (Shuval et al., 2017; USPSTF, 2019). It also consists of Healthcare Effectiveness Data and Information Set (HEDIS)

performance measures applicable to Medicare for physical activity counseling in older adults, and applicable to commercial and Medicaid for physical activity counseling in children (Joy & Sadgrove, 2010; National Committee for Quality Assurance [NCQA], 2019). There are advocacy efforts underway to expand reimbursement for exercise prescriptions/referrals by: clarifying which diagnostic (i.e., ICD-10) and billing (i.e., CPT) codes for physicians and other qualified allied health professionals allow for reimbursement of counseling, prescription and referral as part of health and wellness coaching, behavioral counseling, and chronic care management; and extending HEDIS performance measures for physical activity counseling to adults aged 18 through 64 (ACSM, 2019a; Joy & Sadgrove, 2010). Future research should contribute to an expanded evidence base on the impact of exercise prescriptions/referrals on patient exercise behavior and health outcomes in order to help make the case for reimbursement and cost effectiveness of exercise prescriptions/referrals.

4.3 Interoperability of Electronic Medical Record Systems

The literature suggests that electronic medical record systems can facilitate physicians providing counseling on exercise and making lifestyle-related referrals (Grant et al., 2014). This doctoral project suggests that there is also great potential for electronic medical record systems to facilitate physicians writing exercise prescriptions/referrals, as well as supporting collaboration between physicians and exercise professionals working with referred patients.

The number of U.S. hospitals using electronic records grew from 9% in 2008 to 83% in 2015, but many of the existing systems do not talk to each other and the fax machine is still used for 75% of medical communication (Kliff, 2018). There is a federal regulatory initiative that seeks to improve interoperability and patient access to data; this initiative has garnered recent media attention because of opposition within the healthcare system generally, in contrast

to support from technology companies (Farr, 2020). Exchange of information between electronic medical record systems and social service providers is also challenging, and a number of large U.S. healthcare actors, including CVS Health and Kaiser Permanente, are investing funds in developing healthcare and social care coordination platforms to facilitate referral to community-based organizations (LaRock, 2019). This is relevant for building exercise referral networks between the clinical and community settings as physicians currently rely primarily on fax machines to get exercise prescriptions/referrals to community-based health & fitness centers. Given that Hospital AZ was implementing a new electronic medical record system that will allow physicians to see notes written by exercise professionals on a patient in real time for the first time, future research should include a pre- and post-assessment of Hospital AZ physicians and Health & Fitness Center O exercise professionals' perspectives on communication and collaboration around exercise prescriptions/referrals. It should also include community-based exercise facilities and professionals for additional insight into communication outside the exercise referral network.

5. Next Steps

In order to realize the potential of the clinical setting to influence population-level physical activity as identified in the 2018 Physical Activity Guidelines Advisory Committee Scientific Report, and to implement effective approaches, a number of key steps are needed. First, understanding what patients do with exercise prescriptions/referrals and how they impact patient exercise behavior and health outcomes. Second, understanding and clarifying the call to action to physicians—prescribe or refer or both? Third, understanding where physicians would trust to refer their patients and developing a pathway for health & fitness centers/exercise professionals to become those trusted community resources. In a world where all U.S.

physicians talk to their patients about physical activity and refer their patients to resources that help them move more and sit less, every day, then, and only then, will exercise prescriptions/referrals be an effective approach to helping Americans live longer, healthier, and more active lives.

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VII. APPENDICES

1. APPENDIX A. Physician survey.

Q1 What is your field, please specify:_____?

Q2 Excluding physical therapy referrals, how often do you provide written exercise prescriptions/referrals for your patients?

- Always
- Very often
- Sometimes
- Rarely
- Never

Q3 What type of exercise prescriptions/referrals do you write? Please check all that apply.

- A referral to a hospital-affiliated health & fitness center
- A referral to an unaffiliated health & fitness center, please specify: _____
- A personalized exercise prescription with dosage information, to be filled in a facility
- A personalized exercise prescription with dosage information, to be filled at home
- Other, please specify: _____
- Not Applicable

Q4 What risk factors or conditions prompt you to prescribe exercise to your patients? Please check all that apply.

- High cholesterol
- High blood pressure (hypertension)/ Pre-hypertension
- Diabetes/Pre-diabetes
- Mental health conditions
- Musculoskeletal issues
- Overweight or obesity
- Post-op/rehabilitation
- General wellness/prevention
- I established that the patient was not exercising regularly

- ▢ Other, please specify: _____
- ▢ Not Applicable

Q5 What serves as a barrier to your writing an exercise prescription/making a referral? Please check all that apply.

- ▢ Limited time
- ▢ Lack of reimbursement
- ▢ Lack of knowledge/skills
- ▢ Lack of tools/materials
- ▢ Lack of feedback loop back to me, as a physician
- ▢ Lack of fitness facilities/providers
- ▢ Difficulty locating/nonexistent in electronic medical record
- ▢ Concerns about patient adherence
- ▢ Lack of patient motivation
- ▢ Concerns for patient safety
- ▢ Concerns about exercise professionals
- ▢ Other, please specify: _____

Q6 What is your level of confidence in providing an appropriate exercise prescription with each of the following components?:

	Very confident	Moderately confident	Somewhat Confident	Slightly confident	Not at all confident
Type of exercise	o	o	o	o	o
Frequency of exercise	o	o	o	o	o
Intensity of exercise	o	o	o	o	o
Duration of exercise	o	o	o	o	o

Q7 What is your level of comfort in referring a patient to:?

	Very comfortable	Comfortable	Neutral	Uncomfortable	Very uncomfortable
A hospital-affiliated health & fitness center	o	o	o	o	o
An unaffiliated health & fitness center	o	o	o	o	o
An independent fitness provider not in a facility	o	o	o	o	o

Q8 What are three characteristics of a health & fitness center that you would trust to refer your patients to with an exercise prescription?:

_____

_____

_____

Q9 What are three characteristics of an exercise professional that you would trust to refer your patients to with an exercise prescription?:

_____

_____

_____

Q10 To what extent do patients adhere to the written exercise prescriptions/referrals that you make?

- Always
- Very often
- Sometimes
- Rarely
- Never
- I don't know

Q11 Would you be willing to be contacted for follow-up?:

- Yes
- No

2. APPENDIX B. Exercise Professional Survey.

Q1 What is your field, please specify:_____?

Q2 How often do you work with patients who were referred with an exercise prescription from their physician?

- Always
- Very often
- Sometimes
- Rarely
- Never

Q3 How often do you provide feedback to the referring physician about their patients?

- Always
- Very often
- Sometimes
- Rarely
- Never

Q4 What type of feedback do you provide, please specify:_____?

Q5 What do you find most valuable about exercise prescriptions/referrals?

_____

_____

_____

Q6 How could the prescription/referral process be improved?

_____

_____

_____

Q7 In your experience, what serves as a barrier to patients filling exercise prescriptions? Please check all that apply.

- ▢ Limited time
- ▢ Lack of reimbursement
- ▢ Lack of knowledge/skills about how to fill the prescription
- ▢ Lack of knowledge/skills about where to fill the prescription
- ▢ Lack of fitness facilities/providers
- ▢ Lack of patient motivation
- ▢ Concerns about exercise professionals
- ▢ Other, please specify: _____

Q8 What is your role, as a professional, in helping patients fill exercise prescriptions?

_____

_____

_____

Q9 What is your level of confidence in helping a patient fill an exercise prescription with each of the following components?:

	Very confident	Moderately confident	Somewhat Confident	Slightly confident	Not at all confident
Type of exercise	o	o	o	o	o
Frequency of exercise	o	o	o	o	o
Intensity of exercise	o	o	o	o	o
Duration of exercise	o	o	o	o	o

Q10 What three characteristics of your health & fitness center would make physicians more likely to trust it as somewhere to refer their patients?:

_____

_____

_____

Q11 What three characteristics of you, as a professional, would make physicians more likely to trust you as someone to whom to refer their patients?:

_____

_____

_____

Q12 To what extent do exercise prescriptions change patient exercise behavior?

- To a very great extent
- To a great extent
- To a moderate extent
- To a small extent
- Not at all

Q13 Would you be willing to be contacted for follow-up?:

- Yes
- No

3. APPENDIX C. Physician Interview Guide.

Part I - Practice Patterns
For the first part of this interview, I would like to spend time understanding whether/how you prescribe exercise, and what sort of exercise prescriptions/referrals you make.

- To what extent do you prescribe exercise to your patients?
    - *How often?*
    - *What type of exercise prescriptions/referrals?*
- Why? What are the factors that make you decide that an exercise prescription would be appropriate/valuable for a patient?
- What are best practices for writing exercise prescriptions?
    - *What should exercise prescriptions look like?*
    - *How did you learn how to write exercise prescriptions?*
    - *How would you recommend others learn?*
- To what extent do you see prescribing exercise as part of a physician's role?

Part II - Barriers and Facilitators
For the next part of this interview, I would like to spend time discussing facilitators and barriers to your prescribing exercise to patients.

- Once you have decided it would be appropriate/valuable to prescribe exercise, what are any obstacles to writing the exercise prescription?
    - *Do the obstacles have to do with the content of the prescription, the technical/logistical aspects of the process, the electronic medical records, the patient relationship factors?*
    - *What have you found has been helpful in overcoming any obstacles?*
- One you have prescribed exercise, what are any obstacles to your patient filling the prescription?
    - *What have you found has been helpful in overcoming any obstacles?*
- How confident are you writing exercise prescriptions that address type of exercise?
    - *Frequency of exercise?*
    - *Intensity of exercise?*
    - *Duration of exercise?*
    - *What would make you more confident?*
- What serves as a facilitator to your prescribing exercise?
    - *What types of tools/resources do you find most helpful?*
    - *What would prompt you to prescribe more?*

Part III - Trust and Feedback Loop

For the final part of this interview, I would like to spend time learning where you refer your patients and how you assess the impact on patient health behaviors and health.

- What factors do you consider when deciding where to refer your patients?
    - *Think of a health & fitness center where you refer your patients - what makes it somewhere you want to refer?*
    - *How do you learn about which health & fitness centers are "best?"*
    - *What characteristics does the health & fitness center need to have in order for you to trust it?*
- What factors do you consider when deciding to whom to refer your patients?
    - *Think of an exercise professional to whom you refer your patients - what makes him/her someone to whom you want to refer?*
    - *How do you learn about which exercise professionals are "best?"*
    - *What characteristics does the exercise professional need to have in order for you to trust him/her?*
- Can you tell me about how you collaborate with exercise professionals and health & fitness centers?
    - *To what extent?*
    - *Through what channels?*
    - *What would facilitate collaboration?*
- What is your perception of how exercise prescriptions change patient exercise behavior?
    - *How?*
    - *How much?*
    - *How do you know (i.e. what follow-up mechanisms do you have in place)?*
- What is your perception of how exercise prescriptions change patient health?
    - *How?*
    - *How much?*
    - *How do you know (i.e. what follow-up mechanisms do you have in place)?*

4. APPENDIX D. Exercise Professional Interview Guide.

Part I - Practice Patterns

For the first part of this interview, I would like to spend time understanding your experience with exercise prescriptions/referrals.

- To what extent do you work with patients who were referred with an exercise prescription from their physician?
    - *How often?*
    - *How many?*
    - *How common is it for physicians to write exercise prescriptions?*
    - *What would prompt physicians to write more?*
- What do you like about receiving a physician exercise prescription/referral?
    - *What do you find most valuable?*
    - *Would you like to see more of them?*

- In your experience, what are best practices for physicians writing exercise prescriptions?
    - *What should prescriptions look like?*
- How could the prescription/referral process be improved?
    - *If you could make two changes to improve the efficacy of exercise prescriptions/referrals, what would they be?*
    - *What do you wish physicians did differently in writing exercise prescriptions?*

Part II - Barriers and Facilitators

For the next part of this interview, I would like to spend time discussing facilitators and barriers to patients filling exercise prescriptions.

- What is your perception of what serves as an obstacle to patients filling exercise prescriptions?
    - *How could those barriers be addressed?*
- To what extent do you see exercise prescriptions that address type of exercise?
    - *Frequency of exercise?*
    - *Intensity of exercise?*
    - *Duration of exercise?*
- What is your role, as an exercise professional, in facilitating patients filling exercise prescriptions?
    - *How confident are you in helping patients fill exercise prescriptions?*
    - *What would make you more confident?*
    - *What would prompt patients to adhere more?*

Part III - Trust and Feedback Loop

For the final part of this interview, I would like to spend time learning how you work with physicians and patients on exercise prescriptions, and the impact on patient health behaviors and health.

- What characteristics of your health & fitness center would make physicians more likely to trust it as somewhere to refer their patients?
    - *What might impact their trust/comfort level?*
    - *When you have experienced physicians being reluctant to refer to health & fitness centers, what have been the reasons why?*
    - *How could these be addressed?*
- What characteristics of you, as an exercise professional, would make physicians more likely to trust you as someone to whom to refer their patients?
    - *What might impact their trust/comfort level?*
    - *When you have experienced physicians being reluctant to refer to exercise professionals, what have been the reasons why?*
    - *How could these be addressed?*
    - *Other types of professionals?*
- How do you collaborate with/provide feedback to the referring physician about the patients they have referred to you?
    - *To what extent?*

    - *What type of feedback?*
    - *Through what channels?*
    - *What would facilitate collaboration?*
    - *How could you improve your feedback?*
- What is your perception of how exercise prescriptions change patient exercise behavior?
    - *How?*
    - *How much?*
    - *How do you know (i.e. what is the follow-up mechanism)?*
- What is your perception of how exercise prescriptions change patient health?
    - *How?*
    - *How much?*
    - *How do you know (i.e. what is the follow-up mechanism)?*