

## Promoting Healthy Lifestyles: Alternative Models' Effects (PHLAME)

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### Abstract

The Promoting Healthy Lifestyles: Alternative Models' Effects (PHLAME) study evaluates the efficacy of two intervention strategies for improving nutrition and physical activity practices in fire fighters: a team-centered program and a one-on-one format targeting the individual. PHLAME compares these two behavior change models (the team-based versus the one-on-one approaches) against a usual-care control group. As a group, fire fighters have a concentration of the same harmful behaviors and health risks commonly afflicting the US population. Fire fighters have a unique work structure which is ideal for a team-centered model of behavior change. This strategy, based on Social Learning Theory, focuses on a team of fire fighters who work together on the same shift. If this team-centered model proves successful, it could provide a cost-effective method to impact behavior and be disseminated among fire bureaus and in other team settings. The one-on-one intervention incorporates the Transtheoretical Model of behavior change, uses Motivational Interviewing for its counseling strategy and could be used in the more typical provider–client clinic setting. Findings from PHLAME will provide information about the

process and outcomes of these models' ability to achieve health behavior change.

### Brief rationale

Among the US population, physical inactivity and unhealthy nutrition habits are underlying factors for an estimated 300 000 deaths each year (McGinnis and Meyers, 1995). For the 7 million Americans with known coronary heart disease, lack of regular exercise is the most prevalent cardiac risk factor. In addition, for the 52 million US adults with high cholesterol, the 60 million with hypertension, the 70 million who are obese and the 13 million with Type II diabetes mellitus, regular exercise and dietary modification are recommended as the initial management of their illness (Appel *et al.*, 1997; Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure, 1997; National Cholesterol Education Program Expert Panel, 2001).

Even a modest increase in physical activity may significantly lower the risk of coronary heart disease (Paffenbarger *et al.*, 1993) and favorably modify cardiac risk factors (Goldberg and Elliot, 1994). The role of healthy nutrition in preventing chronic illness is also well established (US Department of Agriculture and US Department of Health and Human Services, 1990; US Preventive Services Task Force, 1996). Up to one-third of both coronary disease and cancer could be prevented with healthy eating habits (Nestle, 1995). In addition, regular exercise and the recommended nutrition practices may be synergistic in promoting health (Blair *et al.*, 1996). Evidence for the benefits of regular physical

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**Table I.** Primary and secondary outcome measures

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Primary outcome measures

- nutrition and eating habits (% calories as fat, daily servings of fruits and vegetables; dietary behaviors)
- cardiorespiratory fitness (measured maximum oxygen uptake)
- self-reported physical activity
- percent body fat by skin-fold measures, hip/waist ratio, height, weight and BMI (body mass index)

Secondary outcomes

- resting blood pressure
  - LDL-cholesterol, HDL-cholesterol and triglyceride levels
  - quality of life index
  - fasting serum glucose level
  - incidence of back and other musculoskeletal injuries
  - hand grip and quadriceps strength
  - back flexibility
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activity and a healthy diet is overwhelming, yet the majority of Americans do neither.

Paradigms used to alter behavior have targeted both individuals and groups. The one-on-one client–provider interaction is based on a clinical model, often with a focus on high-risk individuals. Group interventions use a social influence model with information delivered universally or to a selected high-risk group (Wyman, 1997). However, many of those groups (Campbell *et al.*, 2000; Kristensen, 2000) would not qualify as team-centered formats (Goldberg *et al.*, 1996a). As we define teams, they differ from most worksite programs and are distinguished by several features: ongoing contact; shared activities and interdependence among team members in activities and goals; and similar responsibilities, successes or rewards. Used in this way, the team-centered format has not been well tested as a means for health promotion among adults.

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### Purpose

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The primary goal of the Promoting Healthy Lifestyles: Alternative Models' Effects (PHLAME) study is to implement and prospectively assess two health promotion behavior change interventions, each based on a different theoretical model for promoting healthy nutrition practices and regular physical activity. One intervention targets the individual and uses Motivational Interviewing to

interact, guided by the subject's stage of change [as defined in the Transtheoretical Model (TM)]. The second paradigm is a team-centered, peer-led intervention that uses Social Learning Theory (SLT) as the basis for behavioral change. We compare these two behavior change models against a usual-care control group to provide an understanding of how, under what conditions and at what expense change can occur and be maintained. Achieving and/or maintaining four measurable outcomes will be used to determine the success of the behavior change strategies. The four lifestyle goals are: (1) 30 min of physical activity per day, (2) percent total calories from dietary fat of less than 30%, (3) at least five servings of fruits and vegetables per day and (4) ideal body fat percentage. The primary and secondary outcome measures are shown in Table I.

### Population

Fire fighters are an ideal study population. Despite their demanding jobs, requiring vigorous physical activity while being exposed to extreme heat and the stress of urgent life-threatening situations, studies indicate a high prevalence of sedentary lifestyles, obesity, hypertension, dyslipidemia, certain malignancies and chronic musculoskeletal complaints (Aronson *et al.*, 1994; Guidotti, 1995; Reichelt and Conrad, 1995). Fire fighters have lower physical fitness than those with other hazardous occupations, including police officers

and construction workers (Barnard, 1979). Cardiovascular disease is a significant problem for fire fighters (Melins, 1995). A portion of this finding is due to occupational risks. Fire fighters must perform physically intense work under conditions which increase myocardial oxygen demand, such as high temperatures and carbon monoxide inhalation. Besides job-related hazards, cardiac risk factors are higher among fire fighters than other comparable worker groups, such as longshore workers and lumbermen (Shearer, 1989). The presence of cardiovascular risk factors, combined with physically stressful fire suppression work settings, account for heart attacks causing more than half of their on-the-job deaths (International Association of Fire Fighters, 1976). In a study of 101 Canadian fire fighters, among these who died on the job, almost half died of heart attacks (Fire Fighter Mortality Report, 1976). Although fire fighters recognize the disparity between their occupational demands and physical health, as with the general population, previous lifestyle interventions have been largely unsuccessful (Green and Crouse, 1991).

Fire fighters' work structure is well suited for a team-centered intervention. Fire stations are staffed by three stable shifts of fire fighters. Each shift works 24 h, followed by 48 h off. During their shift, fire fighters live at the station, which has facilities for dining and sleeping, and most stations also have exercise facilities.

Five fire districts in Oregon and Washington were recruited for study, and all stations in those districts (35 total stations) agreed to participate. Three to 14 individuals make up a shift, resulting in a total of nine to 42 fire fighters per station. The total number of fire fighters participating is 600, with approximately 12 stations and 200 individuals in each intervention group. The average age of the participating fire fighters is 42 years, with a high percentage of white (90%) males (96%).

Prior to randomization, stations were grouped by district for logistic purposes and then by profiles consisting of the following demographic indicators: number of station personnel per shift, average number of runs per shift, average age of fire

fighters, average number of years as a fire fighter and average number of years at their current station. Stations were matched in triads according to the closest match of these profiles. Following matching, a balanced randomization assigned stations to one of the three study conditions.

The triad of stations matched for randomization was scheduled for testing within a few weeks of each other to minimize any differential environmental effect. Fire districts accommodated shifts being tested while on duty; thus it takes 3 days to test all three shifts at one station (one shift per day). Shifts from two or three stations are tested over each 3-day testing period. Stations were entered into the study once they completed their baseline testing stations and were not informed of their group assignment until that time. Participating stations will be retested 1 and 2 years later.

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### **Data collection and analyses**

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#### **Pilot study**

A 6-month pilot study of the three conditions was conducted with three fire stations, with one station randomly assigned to each condition (one-on-one, team and usual care). The pilot study was used to refine the intervention protocols, assessment instruments and testing procedures for the full study. Preliminary results of the pilot have been described (Moe *et al.*, 2000; Elliot *et al.*, Submitted).

#### **Outcomes**

Primary outcome measures (Table I) are indices of physical activity [cardiorespiratory fitness (measured maximum oxygen uptake), self-reported physical activity, flexibility (sit-and-reach test, hand grip and quadriceps strength); nutrition and eating habits (percent calories as fat) (Thompson *et al.*, 2002), dietary behaviors, daily servings of fruits and vegetables (Thompson *et al.*, 1998); and anthropometric measures (percent body fat by skin-fold measures, waist/hip circumference, height, weight and body mass index)]. Secondary outcome measures include resting blood pressure, blood glucose, low-density lipoprotein (LDL)-

cholesterol, high-density lipoprotein (HDL)-cholesterol and triglyceride levels, quality of life indices, and musculoskeletal injury rate.

A self-report questionnaire is completed and collected coincident with the visit to assess objective physical measures. This questionnaire includes several instruments which are being used across other studies in the Behavior Change Consortium. The dietary behavior indices include the National Cancer Institute (NCI) Fruit and Vegetable Screener, (Thompson, *et al.*, 2002); the NCI Fat Screener, which is a measure of dietary fat intake from which one may derive percent of calories from fat (Thompson *et al.*, 1998); and the Fat and Fiber Behavior Questionnaire (FFB) by Alan Kristal and colleagues, which measures reported behaviors related to low-fat and high-fiber eating patterns (Kristal *et al.*, 1990, 2000). Other cross-site measures include Treatment Self-Regulation Questionnaire (TSRQ) for Diet and Exercise (Ryan and Connell, 1989); stages of change questions for low fat diet, five or more servings of fruits and vegetables each day, healthy body weight and regular exercise; and the SF-36 (Etringer *et al.*, 1984; Carron *et al.*, 1985; Matthews *et al.*, 1999). The questionnaires also contain items assessing potential mediating variables and stage of change for participants.

The study design, with subjects nested in shifts and at stations and repeated measurements, makes hierarchical linear modeling (HLM) appropriate for analyzing program effects. If we find interclass correlation coefficients of zero for certain variables, then we would use simpler techniques to analyze those parameters. HLM and latent growth modeling will be used to validate a hypothesized model structure, identify relationships and sequences among variables, and produce better estimates of predictors by 'borrowing' information about these relationships. Our statistical techniques will allow insight into the process of behavior change and the individual tracking of stages of change adds another dimension of richness to the analyses. Program implementation and fidelity are being assessed using direct observation and taping of

interactions. The full study began in October 2000 and stations were entered sequentially over an 8-month interval.

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### **Interventions' theoretic underpinnings and methods**

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The intervention contact time and educational content are comparable for the two interventions, and the assessments are the same for all three conditions. Fire fighters from both intervention groups receive the Fire Fighters Health and Fitness Guide, which is an investigator-produced educational resource for their use. Fire fighters from stations randomized to the control or usual-care condition receive only their results of physical testing with a brief interpretation. The results are organized to show results from their physical measures along with the normal values for that test. Information on interpreting values for blood pressure, lipids and maximal oxygen uptake is also included. They are informed that they are free to alter their lifestyles and use their own initiative to improve their health.

#### **One-on-one intervention**

The PHLAME interventions are based on two relatively distinct theoretical frameworks. The first is a one-on-one counseling format, which uses the TM to individualize the interaction to a subject's state of change (Prochaska and DiClemente, 1992; Prochaska *et al.*, 1994) and Motivational Interviewing (Miller, 1985) to facilitate stage-specific change. The dynamic nature of the change process is recognized, with the counseling session tailored to the individual's readiness to adopt and maintain behavior change. As an approach to behavior change, Motivational Interviewing is client-centered, non-confrontational, and emphasizes reflective listening, clarifying problems, delineating personal motivation for change, presenting options, advocating relevant benefits of change and supporting the client's self-efficacy for change (Miller and Rollnick, 1991; Rollnick and Miller, 1995). The model has been applied successfully to exercise (Marcus *et al.*, 1992, 1996) and

dietary interventions (Prochaska *et al.*, 1994; Clark *et al.*, 1996; Lamb and Joshi, 1996; Berg-Smith *et al.*, 1999).

This research group includes individuals with expertise in Motivational Interviewing and application of the TM, including its use for weight-loss (Stevens *et al.*, 1989, 1993a; Lasser *et al.*, 1995), tobacco cessation (Hollis *et al.*, 1993; Stevens *et al.*, 1993b, 1995b; Stevens and Hollis, 1989), promoting exercise (Stevens *et al.*, 1992; Hornbrook *et al.*, 1993) and dietary change (Lasser *et al.*, 1995; Lauer *et al.*, 1995; Stevens *et al.*, 1995a). This experience was used to develop a Motivational Interviewing protocol for fire fighters, train counselors in this method and implement appropriate evaluation of the intervention.

Following initial testing, a fire fighter meets approximately weekly with a health counselor for three to four sessions that are up to 60 min in duration. During the initial session, the counselor and fire fighter discuss specifics of the PHLAME study and the participant's health concerns. An activity commonly conducted during the first session is a values card sort, which helps the counselor better understand how the fire fighter prioritizes issues such as family, honesty, loving, health, and adventure. Together, the counselor and fire fighter explore the relationship among these values, health and their lifestyle. At Session 2, the fire fighter is given results from their physical testing and health habit survey, including their values, normative data and brief health recommendations. Up to two sessions are used to review these results. The counselor uses client-centered counseling techniques to provide support and motivation for behavior change. These may include exploring the pros and cons of health behavior change, defining an action plan around diet or exercise goals, and developing a support plan for continued follow-up. If the fire fighter requests, a single physician meeting also is provided to also discuss the testing results and give advice on where to focus their behavior change.

Following the initial series of meetings, fire fighters receive at least one 6-month check-in phone call, with the possibility of up to 18 follow-

up phone calls, and an additional 4.5 h of contact time to maintain and enhance the change process. The total contact time for this intervention is approximately 8.25 h. During the second year, fire fighters will participate in three or four additional 45-min individualized sessions with additional follow-up phone calls with the health counselor.

The counselors are trained in Motivational Interviewing and have an understanding of nutrition and exercise. Protocol manuals, charting of session notes, audio taping and coding of the taped sessions, and continuous counselor training are used to enhance and monitor fidelity to the intervention and motivational counseling technique.

### **Team-based intervention**

The second paradigm is team-centered and based on SLT or social cognition (Bandura, 1986). It capitalizes on the peer bonds and interdependence of a 'team.' As with the Theory of Reasoned Action, intentions are linked to behaviors (Fishbein and Ajzen, 1975). However, with this model, change also is facilitated by social influences, such as vicarious experiences, modeling, enacted behavioral norms, explicit shared behavioral values and externally reinforced achievements (Goldberg *et al.*, 1996a, 2000).

We previously devised and studied a successful team-centered intervention to deter male high school athletes' use of anabolic steroids and other drugs (Goldberg *et al.*, 1996a). The Athletes Training and Learning to Avoid Steroids (ATLAS) program is a school sport team-centered program where the entire team meets for a series of coach-facilitated classroom sessions with team members subdivided into five to eight student cooperative learning groups (squads).

The ATLAS format achieved significant long-term reductions in use of anabolic steroids and new recreational drug use (amphetamines, marijuana, alcohol and narcotics) was lowered by approximately 50% (Goldberg *et al.*, 1996a). ATLAS also significantly improved exercise and nutrition behaviors, both immediately following the intervention and at 1-year follow-up (Goldberg *et al.*,

**SESSION 1**

**ACTIVITY 1 - 5 minutes**  
**INTRODUCTION TO PHLAME**



**Instructions to Squad Leader:**  
Team members are gathered. Pass out the Fire Fighter Workbooks to team members. Then, read aloud the following points.

- ✓ PHLAME stands for Promoting Healthy Lifestyles: Alternative Models' Effects. PHLAME is a project funded by the National Institutes of Health to study ways to help people achieve and maintain healthy lifestyles. PHLAME compares individual counseling with a team-centered program.
- ✓ Our station was randomly selected for the team-centered program. The team activities were designed so we can work together and influence each other to improve our health habits. Our results will be compared with stations where fire fighters get individual counseling and stations at which fire fighters only receive the results of their testing.
- ✓ Although I am the designated 'Squad Leader,' everyone will be involved in leading these Sessions. We will meet for about an hour once each week for five weeks. During the remainder of the year, we will meet once a week for two weeks every couple of months. We will be retested 12 and 24 months after our initial testing.
- ✓ You will use your PHLAME Workbook during each meeting. Write your name on the cover of your Workbook and open to the PHLAME Team Timeline on the second page of the book. For each session you attend, write in the date of the session and your initials.

**PHLAME'S LIFESTYLE GOALS**

1. Increase physical activity to at least 30-minutes each day.
2. Decrease the calories from fat to less than 30% of total calories.
3. Increase servings of fruits and vegetables to at least 5 a day.
4. Reduce body fat to a healthy level.



**Instructions to Squad Leader: Complete your Squad Leader Team Timeline at the beginning of each session too.**

Fig. 1. Example page from Squad Leaders Manual.

1996b). ATLAS has been cited by the National Institute on Drug Abuse as one of the few research-based, scientifically sound and effective drug use prevention programs (National Institute on Drug Abuse, 1997). A parallel program, structured for the needs of young women athletes [Athletes

Targeting Healthy Exercise and Nutrition Alternatives (ATHENA)], is currently being assessed (Clarke *et al.*, 1996; Elliot *et al.*, 1996).

The success of the ATLAS program led us to develop a team-centered health promotion intervention for adults. Team-centered methods offer a

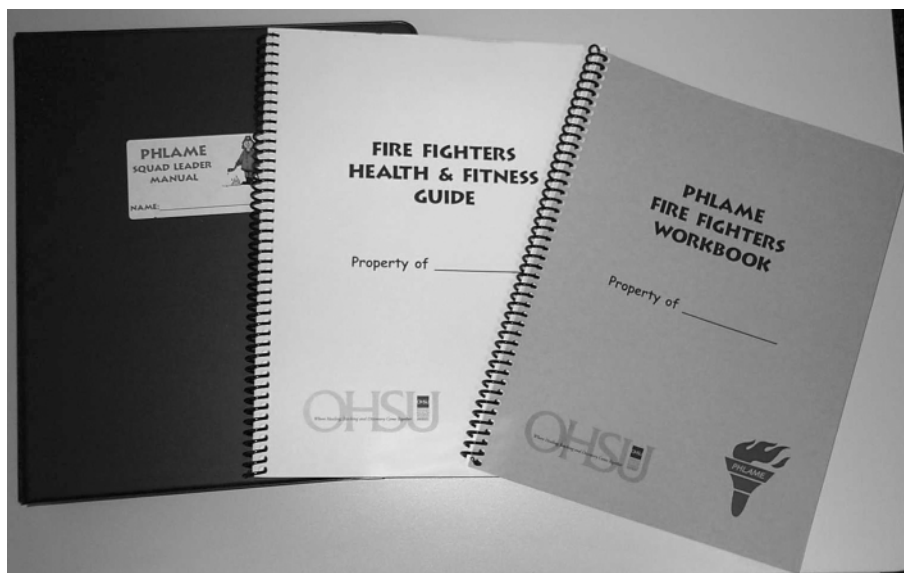


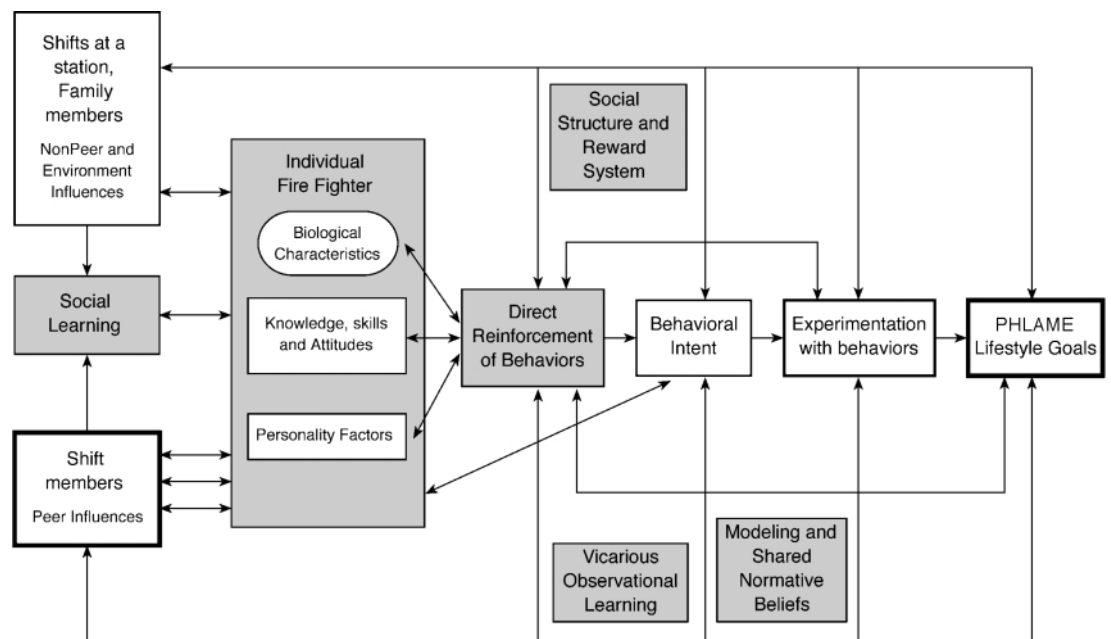
Fig. 2. Materials used in curriculum implementation.

new and potentially more cost-effective paradigm for altering lifestyles. A shift of fire fighters (working 24 h on and 48 h off) provides a ready-made team unit, and their unique peer bonds and shared responsibilities creates a social-unit dimension not present in typical occupations. The intervention is multi-component and occurs during the natural context of participants' work setting. The team curriculum is peer-taught, with one shift member designated and trained as a 'Squad Leader'. He or she receives a 60-min orientation to the format and uses a scripted Squad Leader Manual to facilitate 11, 45-min peer-facilitated classroom sessions. An example of a page from that Manual is shown in Figure 1. The curriculum is scripted with instructions for the Squad Leader in shaded boxes and information which the Squad Leader reads indicated with a check. Squad members use a corresponding Workbook that contains the information and activities, without the Squad Leader instructions and script. The scripted format enhances easy implementation and fidelity to the curriculum.

Pictured in Figure 2 are materials used to implement the team sessions: Squad Leader Manual, Workbook and the Fire Fighters' Health and Fitness

Guide. The Fire Fighters' Health and Fitness Guide is also provided to the one-on-one participants.

The initial five sessions are scheduled consecutively over approximately 2 months. These are followed at 2-month intervals by additional three pairs of meetings (total contact time of 8.25 h). During the first meeting, fire fighters receive the results from their physical testing. The team activities are designed to be fun, educational and allow application of new abilities. Behavior change and self-efficacy are heightened with group problem-solving activities and cooperative learning. Friendly competition and 'positive peer pressure' both among team members and between the shifts at a station is encouraged. During the 2-month intervals when not meeting, ongoing team activities are structured to log and reinforce achievement of and adherence to the study's lifestyle goals. An example of an ongoing activity is a game called the 'Five Alarm Call to Good Health', which challenges each fire fighter to eat at least five fruits and vegetables per day and exercise at least 30 min per day. Fire fighters who meet this challenge use stickers to compare their progress with their fellow shift and station members.



**Fig. 3.** Schematic for SLT showing the variables, their relationships and processes influencing establishing or altering behavior.

**Table II.** Topics included the team-centered curriculum

General topics
introduction to PHLAME
reflecting on change
review, record and chart personal assessment results
Five Alarm Call to Good Health' game
'Food and Fitness Facts Challenge' game
Physical activity
body fuel needs during exercise
fluid needs during exercise
how to improve endurance, strength and flexibility
training heart rate and aerobic exercise
strength training video and workout plan
Nutrition
24-h food record and diet analysis
serving sizes
fats in snack foods
energy balance
protein in foods
fruits and vegetable facts
fast food makeover
analyses of typical snacks

The scope and sequence of the classroom curricular meetings address the domains of PHLAME's lifestyle goals (improve nutrition, increase exercise, increase fruit and vegetable intake, and optimize percent body fat). Topics which address these goals are listed in Table II. During weeks without scheduled team meetings, ongoing activities were incorporated to reinforce the study's lifestyle goals. The importance of change when not at work was emphasized by the game's reinforcement of objectives met both on and off duty.

A subset of sessions are observed by research staff using a performance checklist for fidelity to the curriculum. During year 2, the teams will hold five, 45-min booster sessions with similar activities to reinforce the lifestyle goals.

Figure 3 is a schematic for SLT, which is the basis of the team-based intervention. In this model, behavior is a function of personal abilities and environmental influences. Intentions are influenced

by individual characteristics, direct effects of actions and social influences, and similar forces influence the progression of intentions to behaviors (Fishbein and Ajzen, 1975; Bandura, 1986).

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### Significance

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This research study compares two distinct paradigms for behavior change. It brings together investigators with expertise and experience in two theoretical models for an assessment and comparison of outcomes from these two models in a real-world setting. The study is innovative in its selection of the study population (fire fighters). They are a group present in every community, have a high prevalence of the harmful behaviors that are most prevalent in the general population and their work structure is a natural fit for the team-centered model. Assessing new behavior change paradigms is important for defining cost-effective strategies to promote healthy lifestyles. The one-on-one intervention is a process that could occur as a component of medical care, using Motivational Interviewers as ancillary health care providers. Team-based education is a novel paradigm for altering healthy behavior of adults. If successful, the team-based approach could provide a cost-effective method for public health interventions, and could be disseminated among fire bureaus and adapted for other 'team' settings.

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