Winter 2012

Test model of a healthy lifestyle intervention program

Jorie C. Allen

*University of New Hampshire, Durham*

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Test model of a healthy lifestyle intervention program

Abstract
The purpose of this study was to evaluate whether a worksite health promotion (WHP) delivered in a small workplace, improves health risk factors, is cost-effective, and positively impacts health behaviors.

Comparison (C, n = 31) and Intervention (I, n = 29) groups underwent health risk assessment and screening at baseline, 12 and 24 months. The I group attended lifestyle classes at the workplace and reported pedometer step counts. Data were analyzed using general linear model ANOVA or Chi square analysis.

At 12 months from baseline, the I group had a decreased LDL cholesterol (LDL-C) (126.67 +/- 4.0 mg/dl to 110.86 +/- 4.4 mg/dl p = 0.011), and average steps per day increased (5253 +/- 368 steps, 7149 +/- 400 steps, p = 0.01). No changes were noted in waist circumference (WC), or metabolic syndrome (MetS) markers. In the C group from baseline, WC increased (37.1 +/- 0.4 in, 38.9 +/- 0.4 in, p = 0.001), and MetS markers increased (1.44 +/- 0.1, 1.88 +/- 0.1 markers, p = 0.018) to a value that was also greater than that in the I group at 12 months (1.29 +/- 0.1 markers, p = 0.002). Dietary omega-6/omega-3 fatty acid ratio was found to be greater than that of the I group (14.49 +/- 1.8; 10.33 +/- 2.3, p = 0.03). Cost-effectiveness compared favorably to other studies.

At 24 months, LDL-C and Mets markers were not different from the 12 to 24 month values, either within or between groups. WC of the I group (37.3 in) was significantly less than the C group (38.7 in, p = 0.04). C-reactive protein of the I group was 44% less than that of the C group (p = 0.027). More of the I group than the C group participants reported increased physical activity (84.2% vs. 41.2%, p = 0.007) and improved diet (63.2% vs. 29.4%, p = 0.043). Both groups were highly receptive to a WHP.

This study demonstrated that health risks and health behaviors can improve following a WHP in a small workplace that is also cost-effective, and well-accepted by employees.

Keywords
Health Sciences, Nutrition, Health Sciences, Occupational Health and Safety
TEST MODEL OF A HEALTHY LIFESTYLE INTERVENTION PROGRAM

BY

JORIE C. ALLEN
B.S., UNIVERSITY OF NEW ENGLAND, 1998
M.S., UNIVERSITY OF NEW HAMPSHIRE, 2001

DISSERTATION

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Doctor of Philosophy
in
ANIMAL AND NUTRITIONAL SCIENCES

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This dissertation has been examined and approved:

Dissertation Director,
Anthony R. Tagliaferro,
Professor of Nutritional Sciences

James B. Lewis,
Associate Professor & Chairperson,
Health Management & Policy

Colette H. Janson-Sand,
Associate Professor,
Animal and Nutritional Sciences

Rosemary M. Caron,
Associate Professor,
Health Management & Policy

Ingrid E. Lofgren,
Assistant Professor,
Nutrition & Food Science,
University of Rhode Island

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Date
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ABSTRACT

TEST MODEL OF A HEALTHY LIFESTYLE INTERVENTION PROGRAM

by

JORIE C. ALLEN

University of New Hampshire, December, 2012

The purpose of this study was to evaluate whether a worksite health promotion (WHP) delivered in a small workplace, improves health risk factors, is cost-effective, and positively impacts health behaviors.

Comparison (C, n = 31) and Intervention (I, n = 29) groups underwent health risk assessment and screening at baseline, 12 and 24 months. The I group attended lifestyle classes at the workplace and reported pedometer step counts. Data were analyzed using general linear model ANOVA or Chi square analysis.

At 12 months from baseline, the I group had a decreased LDL cholesterol (LDL-C) (126.67 ±4.0 mg/dl to 110.86 ± 4.4 mg/dl p = 0.011), and average steps per day increased (5253 ± 368 steps, 7149 ± 400 steps, p = 0.01). No changes were noted in waist circumference (WC), or metabolic syndrome (MetS) markers. In the C group from baseline, WC increased (37.1 ±0.4 in, 38.9 ± 0.4 in, p= 0.001), and MetS markers increased (1.44 ± 0.1, 1.88 ± 0.1 markers, p = 0.018) to a value that was also greater than that in the I group at 12 months (1.29 ± 0.1 markers, p = 0.002). Dietary omega-6/omega-3 fatty acid ratio was found to be
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At 24 months, LDL-C and Mets markers were not different from the 12 to 24 month values, either within or between groups. WC of the I group (37.3 in) was significantly less than the C group (38.7 in, p = 0.04). C-reactive protein of the I group was 44% less than that of the C group (p = 0.027). More of the I group than the C group participants reported increased physical activity (84.2% vs. 41.2 %, p = 0.007) and improved diet (63.2% vs. 29.4 %, p = 0.043). Both groups were highly receptive to a WHP.

This study demonstrated that health risks and health behaviors can improve following a WHP in a small workplace that is also cost-effective, and well-accepted by employees.
A paradox of life in Westernized society is that in this age of technological and medical advances, there is an epidemic of lethal chronic disease. Chronic diseases, that include cardiovascular diseases (CVD), coronary heart disease (CHD), and type 2 diabetes mellitus (T2DM), are leading causes of death. Metabolic syndrome (MetS), a clustering of risk factors for all of these conditions is increasing in prevalence, as well. The data that links modern lifestyle to these conditions is extensive; however, there is also a large body of evidence documenting that modification of diet and physical activity can delay onset, prevent, or even reverse these disorders (1). Based on risk factor identification, these conditions are predictable; and importantly, they are also preventable (2, 3).

In 2006, cardiovascular disease (CVD) was estimated to affect 37% of the population. It was the leading cause of death, and ranked highest among all disease categories in hospital discharges. CVD claims more lives each year than cancer, chronic lung disease and accidents combined and was estimated to
generate costs of over $503 billion in 2010. The CVD category of illnesses is broad and includes (CHD), hypertension and stroke (4).

Additionally in 2006, diabetes affected 23.5 million US adults; cost was $174 billion and was the seventh-leading cause of death. However, it is widely believed that diabetes as a cause of death is underreported, since it is a major factor in CHD, stroke and hypertension. CVD is the leading cause of death in people with T2DM; adults with diabetes have heart disease death rates about two to four times higher than adults without diabetes (5).

The metabolic syndrome (MetS) is an additional cardiometabolic risk condition that is defined by markers of dyslipidemia, hypertension, hyperglycemia and central obesity. The clustering of these factors indicates the presence of both prothrombotic and proinflammatory states. When present, MetS increases by twofold the likelihood of developing CVD, and for T2DM, fivefold (6). Approximately 34% of US adults over the age of twenty are believed to have MetS (7). According to a recent update on the revised guidelines of the Third Report of The National Cholesterol Education Program (NCEP III), MetS patients have an average 10-year risk for a first CHD event of up to 18%; and persons with diabetes should be treated as though it were the risk equivalent of existing CHD (8).

An elevated level of blood low-density lipoprotein cholesterol (LDL-C) is a risk factor that is common to both CHD and T2DM and frequently coexists with MetS. In 2009, it was estimated that approximately 36.7 million U.S. adults have high LDL-C levels (≥ 160 mg/dl), with an additional 30.8 million having borderline-
high levels (≥160 mg/dl and ≥130 mg/dl) (9). NCEP III has identified that the principal target for coronary heart disease (CHD) risk reduction is the control of LDL-C (3).

The greatest benefit in risk reduction through the lowering of LDL-C is derived from early intervention, because CVD develops over many years before symptoms become apparent (10). Vascular damage occurs in stages, beginning with the accumulation of modified LDL-C within an arterial wall. Over time, the growing lesion can narrow the vessel lumen. Epidemiological studies have demonstrated that LDL-C levels correlate with CVD risk, and combined analyses, indicate that for every 1% reduction in LDL-C, there is a reduction in CHD risk of at least 1% which is independent of baseline LDL-C levels (11-13).

The inflammatory biomarker, C-reactive protein (CRP) also is predictive of disease outcomes in individuals and may be as important as LDL-C in terms of risk assessment (14, 15), even in apparently healthy individuals (16). Because vascular damage is an inflammatory process, proliferation and migration of cells lead to plaque formation. When the expanded plaque ruptures, the vessel fills with a thrombus, causing occlusion and can result in ischemia or infarction (17). Arterial occlusion can occur without warning, even in asymptomatic individuals. CRP was found to be a strong predictor of the development of T2DM in the Nurse's Health Study (18). In addition, that study determined that undiagnosed vascular damage can be present for up to fifteen years before a diagnosis of T2DM is made in women (19). Changes in dietary pattern that included a reduced consumption of trans fats (82) and a lower ratio of n-6 to n-3 fatty acids
have been associated with both improved LDL-C and CRP following lifestyle intervention studies.

Risk factor modifications have been shown to reduce morbidity and mortality from CVD (10), but it is necessary to identify those individuals at risk. Data from the National Health and Nutrition Examination Survey (NHANES) from 1999 - 2006 show that one-third of the participants with elevated LDL-C were previously unscreened and had missed an opportunity to improve their status. Additionally, one-fourth of those that were screened and had elevated LDL-C, were never told by their health care provider that their cholesterol was high (20). Younger adults, ages 20 – 44 years had a particularly low screening rate regardless of other risk factors (21). A study, that assessed screening rates among 5,025 male and female adult primary care patients (mean age 47.4 years), found that only 40% were screened for LDL-C. Women, in particular, were underscreened for several cardiometabolic risk factors. A conclusion of the study was that health plans and clinical groups should examine screening practices and develop plans to improve screening rates (22). It is estimated that 35% women in the United States have some form of CVD and for men, this number is 37.6% (23).

A lifestyle that limits or does not permit the development of risk factors is the preferred method to lower cardiovascular risk (24). However, the Health Belief Model states that individuals must feel susceptible to a disease or condition before they will take action to decrease their risk. This model relies on assumptions that the individual is aware of what the hazards are in general, and
is able to self-assess their personal risk and confidently begin therapeutic lifestyle change (25). Research has demonstrated that there is a general lack of awareness of healthy levels of risk factors for CVD, and that most individuals do not know their own degree of risk (26, 27).

Conversely, improved awareness is known to increase actions to lower CVD risk (27). Furthermore it has been shown, that when individuals are identified as at-risk for the development of CVD and T2DM and are shown how to make lifestyle changes, risk can be significantly reduced (28). It stands to reason that an intervention program designed to reduce health risks by increased awareness and lifestyle changes could be successful and impact the progression of either CVD or T2DM. In the case of prediabetes, an identifiable condition that precedes the diagnosis of T2DM, lifestyle changes are shown to be even more effective than treatment with medication (29). Interventions with the common goal of reducing risk factor prevalence for CVD and T2DM, affect other chronic diseases such as dyslipidemia, hypertension and obesity. A review of preventive interventions reported that effective primary prevention treatments for T2DM are effective in those chronic conditions, as well (30). Despite the strong evidence supporting the promotion of a healthy lifestyle to prevent chronic disease, dissemination and implementation of intervention programs have been problematic because there are few options that are low-cost and commonly accessible.

The Centers for Disease Control and Prevention (CDC) suggest that worksites are uniquely positioned to provide effective programs that improve
health, because more than one-half of waking hours are spent at work. Therefore, employees are a potential captive audience for programs that include health screenings and educational sessions (31). In 2009, an estimated 60% of U.S. adults older than 18 years were employed; and of those, 16% were older than 65 years (32). In fact, worksite health promotion (WHP) has been shown to successfully educate employees, screen, and reduce risk for the development of chronic disease (33-37).

Goetzel et al. found that employees with modifiable lifestyle risk factors cost employers 228% more in health care costs relative to risk-free employees (38). Multiple studies have shown that health care costs and absenteeism are decreased when employee’s health risks are reduced through WHP (39). In 2005, it was reported that participants in WHPs had 25% - 30% lower medical and absenteeism costs compared to non-participants (40). Moreover, a 2010 meta-analysis of twenty-two studies on cost savings, associated with WHPs, found that the average employer yielded cost-savings of $358 per participating employee in 2009 dollars (41). Because most of the studies evaluated in the aforementioned review were implemented by large employers (more than 1,000 employees), these positive findings might not pertain to smaller employers. Currently, eighty-five percent of U.S. employers have fewer than 100 employees (42). From the perspective of the smaller employer, it would be important to determine not only that an employer-sponsored wellness program improves the health of employees, but that it is also cost-effective when compared to the potential consequences of deteriorating employee health.
The purpose of the following intervention study was to evaluate the impact and cost-effectiveness of a lifestyle intervention program on the health status of the employees of a small (172 employee), decentralized organization. Our worksite health promotion (WHP) assessed CHD risk in employees of University of New Hampshire Cooperative Extension (UNHCE), and provided an educational intervention to promote healthy lifestyle changes.

**Research Objectives**

A two-year intervention study of consecutive twelve-month periods was designed to: 1) evaluate the impact and cost-effectiveness of a lifestyle intervention program on the health status of employees of UNH Cooperative Extension (UNHCE) in year one and, 2) determine if any positive changes in lifestyle, clinical measurements and health risk factors achieved after 1 year in employees of UNHCE are sustained in year two.

**Methods**

**Randomization / Allocation**

UNH Cooperative Extension is based on the UNH Durham campus; however, it has ten additional regional worksites throughout the state of New Hampshire. Participants were recruited from all of the UNHCE offices, sixty-four of the 172 employees (37%, 6 male, 58 female) from ten sites volunteered. Assignment of subjects to treatment groups was dependent on site; 18 volunteers from the five out of ten total sites that had no access to videoconferencing were assigned, by default, to the Comparison (C) group.
Volunteers from the remaining sites were randomized on a proportional basis to either the Intervention (I) or C group. This allocation resulted in C and I groups of 32 subjects, each. Subjects signed an informed consent document and were not compensated. The use of human subjects in this study was approved by the University of New Hampshire (UNH) Institutional Review Board for the Protection of Human Subjects in Research (IRB). Testing was conducted at county offices of UNHCE or on the UNH campus. Comprehensive testing was performed at baseline, twelve months and 24 months with additional blood tests at six and eighteen months.

After randomization, but prior to baseline testing, four volunteers withdrew from the study (2 did not want to commit to the conditions of the study, 1 job change, 1 personal), leaving 31 C and 29 I participants at baseline. During year one, five subjects withdrew (3 personal, 2 job change), leaving 28 C and 27 I participants at 12 months. During year two, twelve additional volunteers (6 personal, 4 retired, 1 job change, 1 illness) withdrew leaving 23 C subjects and 20 I subjects at 24 months. (Figure 1.1).

**Anthropometric and Biochemical Screening Tests**

All participants were tested, using fingerstick samples of whole blood, after an overnight fast for: total cholesterol (TC), HDL-cholesterol (HDL-C), LDL-cholesterol (LDL-C), total cholesterol to HDL-cholesterol ratio (TCHDL), triglycerides (TRG) glucose (FG) and high-sensitivity C-reactive protein (hsCRP). Samples were analyzed enzymatically using a small, portable analyzer (Cholestech LDX system, Cholestech Corporation. Hayward, CA).
Figure 1.1 Participant Allocation and Withdrawals

Before allocation of subjects to experimental groups, it was necessary to assess each UNHCE worksite individually for membership in the Granite State Distance Learning Network (GSDLN). If GSDLN was not available, participants from those sites received a default assignment to the comparison group. Eighteen participants from these offices were allocated to the comparison group. Since the number of volunteers from each of the offices that were part of GSDLN was different, the random selection of fourteen comparison subjects was done on a proportional basis, with at least one participant from each site assigned to the comparison group. This allocation resulted in comparison and intervention groups of 32 subjects each.
Height and weight were measured using a portable Health-O-Meter 402 medical beam scale with non-detachable weights and an 84” sliding stadiometer. Waist circumference (WC) was measured using a non-stretchable, flexible tape measure placed at the level of the iliac crest parallel with the floor. Measurement was made at the end of a normal expiration.

Percent fat mass (PCTFM), total body water percent (TBWPCT), and body mass index (BMI), were measured using a portable, battery-operated bioimpedance analyzer BIA 450, Biodynamics Corporation, Seattle, WA). The BMI value that is reported by the BIA 450 is based on Quetelet’s Index: Weight / \(\text{Height}^2\) (43).

Following BIA measurement, systolic (SBP) and diastolic blood pressures (DBP) were measured in the right arm of subjects in the supine position, using a clinically approved automated oscillometric monitor (Omron HEM-711 AC(N), Omron Healthcare, Inc, Bannockburn, Illinois) according to standard protocols. Metabolic syndrome markers were counted based on the definition of MetS components by the NCEP ATP III. These factors included WC > 102 cm. (40 in.) for men and > 88 cm. (35 in.) for women, HDL-C < 40 mg/dl in men and < 50 mg/dl in women, TG ≥ 150 mg/dl, BP ≥ 130 /≥ 85 mmHg and FG ≥ 100 mg/dl (44). A copy of screening test results was presented to each participant and discussed immediately following testing.

Starting in month 5 of year one, subjects also received monthly health newsletters by electronic mail (e-mail) in year one: and in year two, four quarterly. Each issue had a particular focus such as, T2DM or MetS, and was
written so that the purpose of the material was easily understood and in a style that was active and personal. (Table 1.1).

**Pulmonary Function Studies**

Since pulmonary function has been reported to be inversely related with insulin sensitivity and WC (45, 46), each participant was given and instructed in the use of a new, hand-held digital peak flow meter (Koko Peak Pro6, Bionostics Inc 7 Jackson Rd, Ayer, MA 01432) that measured peak expiratory flow rate (PEF) and forced expiratory volume in one second (FEV₁).

Participants were also given written, illustrated instructions and a printed form on which to self-record results. They were asked to perform the test at home in the morning and evening at the same times each day for a week in the month following the health screening.

Measurement of PEF and FEV₁ was repeated three times at each testing, with the highest value of the three recorded. Participants were asked to mail the record sheet to the primary research investigator when completed. The use of a handheld spirometer in research settings has been justified (47) and the collection of three, unsupervised efforts at a time has been found to be adequate (48).
## Table 1.1. Contents of UNHCE Workplace Health Promotion Newsletters

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*How to stay hydrated*  
*If the shoe fits...*  
*Your steps count*  
*Tips for staying physically active*  
*Take it slow* | **Vol. 1 (7)** | *The body’s reaction to stress*  
*Stress increases risk of illness*  
*Stress and exercise*  
*Stress and sleep*  
*Ways to reduce stress* |
| **Vol. 1 (2)** | *Wellness: what’s in it for you?*  
*Metabolic syndrome, heart disease, diabetes*  
*Strategies for dealing with the holidays*  
*Holiday recipe*  
*Alcohol intake during the holidays* | **Vol. 2 (1)** | *Increasing prevalence of diabetes*  
*Risk factors for diabetes*  
*Metabolic syndrome increases diabetes risk*  
*Diabetes prevention*  
*Exercise helps!* |
| **Vol. 1 (3)** | *Resolutions for a healthy year*  
*Components of a healthy diet: Carbohydrates*  
*Simple vs. complex carbohydrates*  
*Whole grains and fiber*  
*Recipe* | **Vol. 2 (2)** | *Identifying and modifying CVD risk*  
*Atherosclerosis*  
*Important considerations for women*  
*Blood pressure, cholesterol and triglycerides*  
*Heart healthy diet / good fats and bad fats* |
| **Vol. 1 (4)** | *Dietary fats: why we need them*  
*Good ones, not-so-good ones*  
*Ways to add healthy fats to your diet*  
*Recipe* | **Vol. 2 (3)** | *What is stress?*  
*Mind-body connection*  
*Stress at work*  
*Stress management* |
| **Vol. 1 (5)** | *What are proteins?*  
*Sources of protein*  
*Meat and meat alternatives*  
*Ways to add protein to your diet*  
'The skinny' on high protein diets  
*Recipe* | **Vol. 2 (4)** | *Maintenance of a Healthy Lifestyle*  
*Prevent the Preventable*  
*Why Work at Health?*  
*Why Health at Work?*  
*Keep it Simple* |
| **Vol. 1 (6)** | *What is osteoporosis?*  
*What are the risk factors?*  
*Dietary sources of calcium*  
*Calcium supplements*  
*Recipe* | **Vol. 2 (4)** | *Maintenance of a Healthy Lifestyle*  
*Prevent the Preventable*  
*Why Work at Health?*  
*Why Health at Work?*  
*Keep it Simple* |

Newsletters were formatted for and delivered by email to all WHP participants. Vol. 1 = year 1, Vol. 2 = Year 2. The newsletters can be viewed on the enclosed CD.
Test values were compared to predicted normal values for PEF (49) and FEV₁ (50) using a web-based resource, the Medical Algorithms Projects (www.medal.org) and calculated using the equation:

\[
\text{Percent of predicted} = \frac{\text{measured PEF or FEV₁}}{\text{predicted PEF or FEV₁}} \times 100.
\]

Measurement of diurnal variation of the PEF was calculated by using the following equations:

\[
\text{PEFvar} = \text{absolute value} (\text{PEFpm} - \text{PEFam})
\]

\[
\text{Average amplitude percent} = \left( \frac{\text{PEFvar}}{\text{PEFavg}} \right) \times 100
\]

Due to a relatively poor return of completed self-reported record sheets (18% at 12 months) permission was sought and received from the IRB to collect a one-time observed measurement of PEF and FEV₁ performed in the presence of and recorded by the primary research investigator. This observed test was conducted at the final health screening in year two in the same manner as the self-reported tests. The variation between the mean self-reported tests of PEF and FEV₁ at 24 months and the researcher-observed tests at 24 months was calculated as a percent of the observed measure:

\[
\text{Self-reported measure} / \text{researcher-observed measure} \times 100
\]

**Diet Record Collection and Analysis**

Analysis of dietary nutrients was based on self-reported three-day food records completed at baseline, 12 months, and 24 months. Subjects were given full instructions for keeping a food record that included printed examples and
picture guides for estimating food portions. Specifically, participants were asked to record on the provided forms, all foods and beverages, including water, consumed on three typical non-consecutive days, with one of those being a weekend day, and to return the record to the project coordinator by mail (self-addressed stamped envelopes were provided). Dietary data were analyzed by a commercial software program with a 20,000+ food database (Diet Analysis Plus 8.0, Wadsworth Publishing). Analyses were performed on data sets collected for year one (baseline to 12 months) and year two (12 to 24 months). In addition, separate standalone analyses were performed at baseline, 12 and 24 months. Results were reported as total grams consumed or as a percent of total kilocalories consumed and compared to Dietary Reference Intakes (DRI) for each individual.

Of particular interest in this investigation was energy and fat consumption, due to their purported influence on the risk for T2DM, CVD and MetS. Total fat intake was categorized according to fatty acid saturation (i.e., saturated, monounsaturated, polyunsaturated) and unspecified fats. The category of unspecified fats as defined by Diet Analysis Plus 8.0 may include any type of fat that is not classified as saturated, monounsaturated, or polyunsaturated by a food manufacturer or laboratory nutrient analysis, such as: trans fats, fractionated oils, phospholipids, sterols (cholesterol), glycerol, monoglycerides, and diglycerides. Omega-3 (n-3) and omega-6 (n-6) polyunsaturated fatty acids (PUFAs) were also evaluated and used to calculate the n-6 to n-3 ratio (n-6/n-3 ratio) as follows:
\[ \text{n-6/n-3 ratio} = \frac{n-6 \text{ PUFA gms}}{n-3 \text{ PUFA gms}} \]

Analysis of a subset of diet records returned by the same participants that completed records at both baseline and 12 months, was done to determine if there had been changes in consumption of food group servings. The food-group analysis was based on the portion sizes and categories of the former U.S. Department of Agriculture Center for Nutrition Policy & Promotion MyPyramid (www.MyPyramid.gov) as follows:

- **Fruit Group** should provide 4 daily servings, or 2 cups.
- **Vegetable Group** should provide 5 servings, or 2.5 cups.
- **Grain Group** should provide 6 ounce-equivalents (1 ounce-equivalent means 1 serving), half of which should be whole grains.
- **Meat and Beans Group** should provide 5.5 ounce-equivalents or servings.
- **Milk Group** should provide 3 cups/servings.
- **Oils** should provide 24g or 6 teaspoons.
- **Discretionary Calories**: The remaining amount of calories in each calorie level after nutrient-dense foods have been chosen.

**Health Questionnaire and Exit Survey**

**Health Questionnaire.** Self-administered questionnaires were distributed at baseline, 12 months and 24 months. The questionnaires were designed for use by the UNH Center for Health Enhancement (CHE) weight management program. Questions were categorized as descriptive, quantitative, qualitative, or participatory.
Descriptive questions queried frequency of medical check-ups, out-of-pocket medical expenses, sick day absences, medication use and consumption of dietary supplements. Response frequency percentages were calculated by the following formula:

\[
\text{Response } \% = \left( \frac{\text{Frequency of each response}}{\text{total responses within the treatment group}} \right) \times 100
\]

Quantitative questions queried participant's perceptions of how important it is to them to make lifestyle changes, readiness to make lifestyle changes, confidence in ability to make changes and levels of stress on a scale of zero to ten. Lifestyle changes were defined as changes to improve health, such as adjusting diet, increasing physical activity, and changing health-related behaviors. An example of a scaled-response quantitative question follows:

*Put an X on the line to show how ready you are right now, on a scale of 0 to 10, to make lifestyle changes. (0 = not very ready, 5 = somewhat ready 10 = very ready)*

Qualitative questions were open-ended queries that asked subjects what lifestyle changes they were willing to make, and what they perceive as barriers to making lifestyle changes. For those open-ended responses, general themes were identified and assigned a category code. For example, responses to the question “What lifestyle changes would you be willing to make?” would be assigned to one or more of eight categories: none, consume or manage a healthier diet, increase or maintain exercise, both improve/maintain diet and
improve/maintain exercise, manage weight, stress management, or other. Three trained raters read the responses (identity and treatment group were blinded) and assigned one or more codes to each. Final determination of categories for each response was made when at least two of the three raters had assigned the same code to a response. The code assigned by the pre-appointed referee rater was recorded in the few instances when a response was not given the same code by at least two raters. To determine the measure of agreement among raters, the free-marginal kappa (k_free) was calculated using an online calculator. The calculator was specific for use when multiple raters are not restricted in the number of codes that are assigned to a singular response. According to Randolph, a kappa of .70 or above indicates adequate interrater agreement (51).

An example of a qualitative question was:

“What things might make it hard for you to make lifestyle changes?”

At 24 months, subjects reported how participation in the WHP impacted their lifestyle, health, and how they feel. Responses utilized a Likert-like balanced scale. An example of a participatory question follows:

Has participation in the UNH Cooperative Extension Workplace Wellness Study impacted your lifestyle? (stayed the same, improved a little, improved somewhat, improved a lot, worsened a little, worsened somewhat, worsened a lot).

Because a relatively small number of responses were spread over seven options in the participatory questions, sparse entries for some of the response cells prevented making a meaningful statistical comparison in that form.
Therefore, responses were then grouped into three categories for analysis: 1) stayed the same, 2) improved or, 3) worsened.

A complete description of results and discussion of the Health Questionnaire will be presented in Chapter 3. Please refer to the Appendix for a complete version of the Health and Wellness Questionnaire.

**Exit Survey.** An Exit survey was given at the final health screening at 24 months. The three-question survey queried changes in lifestyle and health as a result of participation in the study and overall satisfaction with the program. An example of an Exit question was:

*As a result of participating in the UNHCE Workplace Wellness program: What lifestyle changes (for example, healthy diet and activity choices, health maintenance and stress management) have you made? Please be specific.*

The open-ended Exit responses were treated in the same manner as described above for qualitative questionnaire responses. A complete description of results and discussion of the Exit Survey will be presented in Chapter 3. Please refer to the Appendix for a list of the Exit Survey questions.

**Calculations**

Computation of relative and absolute changes in variables followed the calculations of Soler et al., from their 2010 review of the effectiveness of Worksite Health Promotions (52):

\[
\text{Absolute change} = (l_{\text{post}} - l_{\text{pre}}) - (C_{\text{post}} - C_{\text{pre}})
\]

\[
\text{Relative change} = [(l_{\text{post}} / l_{\text{pre}}) / (C_{\text{post}} / C_{\text{pre}}) - 1] \times 100\%
\]
Where \( I = \) [mean value for intervention group], \( C = \) [mean value for comparison group], \( \text{pre} = \) [baseline measurement], and \( \text{post} = \) [12-month measurement].

The cost-effectiveness ratio (C-E ratio) of the intervention was computed by dividing the per-capita cost of the intervention by the relative percentage-point reduction in LDL-C:

\[
\text{C-E ratio} = \frac{\text{Cost of intervention}}{\text{Unit of effectiveness}}
\]

A complete description of the cost-effectiveness analysis is discussed in Chapter 2.

**Intervention**

The intervention consisted of a wellness education program and the distribution of pedometers. The C group did not participate in either component.

**Wellness Education Program.** The wellness education program was presented to participants using The Granite State Distance Learning Network (GSDLN). GSDLN is a partnership of organizations providing an interactive videoconferencing network across the state of New Hampshire (http://gsdln.org/index.html). UNHCE offices that are subscribers to the network have a meeting room equipped with the audio and video technology needed to conduct an interactive conference. Each education module was 30 – 35 minutes in length and presented by the investigator using PowerPoint® presentation graphics software (Microsoft, Inc). Each presentation focused on a different health topic such as CVD risk, diabetes, or hypertension and emphasized the
relationship between a healthy diet and physical activity in disease prevention. (Table 1.2).

Participants were encouraged to interact with questions and observations. In year one, ten monthly videoconferences were presented. In year two, four quarterly videoconferences were presented.

The presentations in year one were accompanied by food samplings provided by volunteer facilitators at each site, at the direction of the investigator. Foods were chosen for their nutritional benefit and ease of preparation, and also to introduce the participants to healthy foods that might be unfamiliar or be perceived as unappetizing. Examples included: whole-grain cereal products, meatless dishes, reduced-fat dairy products, healthy snack options, and a variety of less well-known fruits and vegetables. Participants were encouraged to email the primary investigator with any additional questions, suggestions and to offer evaluation of the program.

**Pedometer Distribution.** Intervention subjects were given a new pedometer (Digi-Walker™ SW-401, Lees Summit, MO). Participants were instructed to wear the pedometers during waking hours, to increase their steps to 10,000 or more daily and to report their activity totals weekly. Studies suggest that 10,000 steps/day is a reasonable level for healthy adults to attain the health benefits of regular exercise (53). Alternative activities, such as bicycling, were converted to steps using a conversion table provided by the University of New Hampshire Center for Health Enhancement. Step counts were reported weekly.
by Intervention participants only, and are presented as average steps per day per each thirteen-week quarter of the year.

**Statistics**

Analyses were based on the assigned treatment at the time of randomization, regardless of adherence, and all participants’ data were included in the primary analyses. Data from anthropometric, biochemical, clinical, dietary, descriptive and quantitative questionnaire responses, and frequency counts of questionnaire and exit survey responses were analyzed using general linear model (GLM) ANOVA for repeated measures. Anthropometric, biochemical, clinical and dietary data were corrected for age and gender, with exception of percent predicted pulmonary tests. A self-reported diagnosis of asthma and/or the use of bronchodilators were entered as covariates in the GLM model for pulmonary tests. Since values of blood hsCRP were skewed, the data were log-transformed for parametric analysis. At 12 months, data from one C group participant was identified as being an outlier in the analysis of missed days at work for year one. Data for this participant was omitted for that analysis only.

Post-hoc analyses were conducted using Tukey’s Honestly Significant Difference test. Pearson’s Chi square analysis was used to examine questionnaire descriptive responses, individual categories of qualitative responses, and same vs. improved participation questions. Data are presented as mean ± SE, unless indicated otherwise. The level of statistical significance was set at p ≤ 0.05. Statistical analyses were performed using SYSTAT 12 © Copyright 2007, SYSTAT Software, Inc.
### Table 1.2. Topics Included in UNHCE Workplace Health Promotion Educational Sessions

<table>
<thead>
<tr>
<th>Year 1</th>
</tr>
</thead>
</table>
| **Introduction/ Proper footwear** | • Introduction to Workplace Health Promotion  
• Schedule for sessions  
• Choosing the proper exercise shoe for you\(^1\)  
• Question and answer session |
| **Physical Activity / Pedometers / Hydration** | • Benefits of regular physical activity  
• Keeping hydrated  
• Why use pedometers  
• Pedometer questions  
• Smart Holiday Choices  
• Question and answer session  
• Snack- green tea |
| **Healthy Living / Healthy Eating / Healthy Body** | • How lifestyle makes a difference  
• Get ready for the holidays  
• Obesity facts and statistics  
• Comorbidities of obesity  
• Energy balance for weight loss  
• The Holidays and Your Health: Alcohol  
• Holidays at the Office  
• Question and answer session  
• Snack – spiced oranges |
| **Carbohydrates** | • Diet resolutions  
• What is a healthy diet?  
• Carbohydrates  
• Simple VS Complex  
• Whole grains/Fiber  
• Low-carbohydrate diets  
• Question and answer session  
• Snack- whole grain crackers, breads with hummus |
| **About Fats –** | • What fats are and why we need them in our body.  
• The good ones, and the not so good ones.  
• Benefits of healthy fats.  
• Easy ways to add healthy fats to your diet!  
• Question and answer session  
• Snack – low-fat or fat-free cheeses |
| **Protein and Meat Alternatives** | • What are Proteins?  
• Sources of Protein  
• Meat & Meat Alternatives  
• Importance of non-meat sources of proteins  
• Easy ways to add healthy protein to your diet  
• Question and answer session  
• Snack – meatless chili |
| **Healthy Bones\(^2\)** | • Implications of osteoporosis  
• Risk factors / Diagnosis  
• Current and future treatment  
• Resistance exercise  
• Question and answer session  
• Snack –Spinach dip with fat-free sour cream |
### Table 1.2, continued

| Stress | • Prevalence of Stress  
• The body’s reaction to stress  
• Risks of Chronic Stress  
• Connection between stress and sleep  
• Connection between stress and exercise  
• Coping with stress  
• Question and answer session  
• Herbal tea |
| --- | --- |
| Fruits, Vegetables and “Functional” Foods | • Fruits and vegetables reduce disease risk  
• Antioxidants and phytochemicals  
• How much should I eat?  
• “What’s that?” quiz (novel fruits and vegetables)  
• Tips to Eat More (fruits and vegetables, that is!)  
• Question and answer session  
• Snack: star fruits, Asian pears, rainbow carrots |
| Year 2 |  |
| Diabetes and Prediabetes – Opportunity for prevention | • What is diabetes?  
• Complications of diabetes  
• Prevention of diabetes  
• Lifestyle modification  
• Modifiable risk factors  
• How adiposity contributes to diabetes risk  
• Metabolic syndrome  
• Pre diabetes and the “ticking time bomb” |
| Heart Disease Risk | • Resolutions for a healthy year  
• Workplace wellness program goals  
• Be active!  
• Atherosclerosis  
• Function of cholesterol in the body  
• NCEP-III recommendations  
• Dietary fats  
• CVD risk factors  
• Women’s risk |
| Stress management | • What is stress?  
• Mind-Body Connection  
• How it works – stress response  
• Chronic stress  
• Speaking of work…  
• Stress reduction |
| Maintenance of a healthy lifestyle | • Why work at health?  
• Preventing the preventable  
• Healthy employees save money, and so do their employers |

1Presented by Certified Athletic Trainer, 2Presented by guest graduate student in Nutritional Sciences  
One-hour sessions were presented using PowerPoint® and delivered simultaneously to all sites using videoconferencing and were followed by discussion, questions and answers, and food tastings when appropriate for topic.

23
Results

Lipids, Glucose, hsCRP

No differences in baseline measures were found between groups in age, anthropometric and biochemical screening tests or markers of metabolic syndrome. (Table 1.3).

At 12 months, LDL-C of the I group had a decrease from baseline and was significantly less than that of the C group (110.86 ± 4.4 mg/dl, 126.67 ± 4.0 mg/dl respectively, p = 0.011). TC of the I group decreased significantly from baseline at 12 months, and also was less than that found in the C group at 12 months (183.4 ± 4.4 mg/dl, 198.6 mg/dl, respectively, p = 0.001 within group, 0.013 between groups). TC of the C group was not different from baseline at the end of one year. No other within-group or between-group differences in, HDL-C, TC/HDL, TRG, FG or hsCRP were found at 12 months.

At 24 months, hsCRP of the I group was 44% less than that of the C group at 24 months (p = 0.027). TC and LDL-C were not statistically different from the 12 month to 24 month value, either within-group or between-groups; nor were any within-group or between-group differences observed in, HDL-C, TC/HDL, TRG, or FG.

During year one and year two, fasting lipids and glucose also were measured at six-month intervals (months 6 and 18). When analyzed at months 0, 6, and 12, TC of the I group showed a significant decrease from baseline (205.27 ± 4.4 mg/dl, 188.01 ± 4.7 mg/dl, p = 0.017). No within-group or between-group
differences in TC were measured in the C group. No within-group or between-group differences in other lipids were found. In year two, no differences in lipids were seen either within-group or between groups in six-month intervals of 12, 18 and 24 months.

At six months, FG increased significantly from baseline in both C and I groups (increases of 8.9 mg/dl, 7.6 mg/dl, respectively, both \(p = 0.001\) from baseline) but, when analysis of FG was repeated adding season as a covariate, statistical differences were abolished for year one. In year two, no between group or within group differences in FG were found. When season was added as a covariate to the year two analysis, a between group difference in FG (C = 89.8 ± 1.8 mg/dl, I = 95.9 ± 1.9 mg/dl, \(p = 0.038\)) at eighteen months was observed that was not present at either 12 or 24 months.

**Waist Circumference, Blood Pressure, Body Composition**

At 12 months, there was no change in WC of the I group but, the mean WC of the C group increased significantly from baseline, (37.1 ±0.4 vs.38.9 ± 0.4 in, respectively, \(p= 0.001\)). The difference in WC between groups at 12 months was not significant. No other within-group or between-group differences in weight, BMI, PCTFM, TBWPCT, SBP or DBP were observed at 12 months.

At 24 months, WC of the I group (37.3 in) was significantly less than the C group (38.7 in, \(p = 0.04\)). No other within-group or between-group differences in blood pressure or measures of body composition were observed at 24 months.
Metabolic Syndrome Markers

The mean number of MetS markers increased in the C group from baseline to 12 months (1.44 ± 0.1, 1.88 ± 0.1 markers, p = 0.018), a value that also was greater than that measured in the I group at 12 months (1.29 ± 0.1 markers, p = 0.002). No within-group difference was noted in the I group. In year two, no within-group changes from the 12 month values of MetS were seen in either treatment group, nor were any between-group differences measured at either 12 or 24 months. (Table 1.3).
Table 1.3 Health Screening Measurements

<table>
<thead>
<tr>
<th>Variable</th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Comparison Baseline</td>
<td>12 Months</td>
</tr>
<tr>
<td></td>
<td>n = 31</td>
<td>n = 29</td>
</tr>
<tr>
<td>Age (years)</td>
<td>48.5 ± 1.6</td>
<td>48.5 ± 1.9</td>
</tr>
<tr>
<td>Weight (lbs)</td>
<td>180.4 ± 8.7</td>
<td>185.5 ± 9.0</td>
</tr>
<tr>
<td>Body Mass Index (kg/m²)</td>
<td>28.0 ± 1.4</td>
<td>28.5 ± 1.4</td>
</tr>
<tr>
<td>Waist Circumference (inches)</td>
<td>37.1 ± 0.4</td>
<td>38.9 ± 0.4***</td>
</tr>
<tr>
<td>Body Fat %</td>
<td>31.1 ± 1.4</td>
<td>30.3 ± 1.5</td>
</tr>
<tr>
<td>Body Fat %</td>
<td>49.5 ± 1.1</td>
<td>50.4 ± 1.1</td>
</tr>
<tr>
<td>Systolic Blood Pressure (mm/Hg)</td>
<td>125.6 ± 1.5</td>
<td>131.0 ± 1.6</td>
</tr>
<tr>
<td>Diastolic Blood Pressure (mm/Hg)</td>
<td>84.6 ± 2.1</td>
<td>82.7 ± 2.1</td>
</tr>
<tr>
<td>Total Cholesterol (mg/dl)</td>
<td>200.1 ± 3.7</td>
<td>198.6 ± 3.9</td>
</tr>
<tr>
<td>HDL-C (mg/dl)</td>
<td>54.7 ± 3.0</td>
<td>48.1 ± 3.2</td>
</tr>
<tr>
<td>Triglycerides (mg/dl)</td>
<td>145.7 ± 15.7</td>
<td>153.8 ± 16.3</td>
</tr>
<tr>
<td>LDL-C (mg/dl)</td>
<td>121.0 ± 3.7</td>
<td>126.7 ± 4.0</td>
</tr>
<tr>
<td>TC/HDL</td>
<td>4.1 ± 0.2</td>
<td>4.4 ± 0.3</td>
</tr>
<tr>
<td>Fasting Glucose (mg/dl)</td>
<td>88.5 ± 1.3</td>
<td>92.0 ± 1.3</td>
</tr>
<tr>
<td>hsC-Reactive Protein (mg/L)</td>
<td>2.2 ± 0.3</td>
<td>2.8 ± 0.3</td>
</tr>
<tr>
<td>Metabolic Syndrome Markers</td>
<td>1.4 ± 0.1</td>
<td>1.9 ± 0.1^*</td>
</tr>
</tbody>
</table>

*p ≤ 0.05 within group, **p ≤ 0.01 within group, *** p ≤ 0.001 within group, ^ p ≤ 0.05 between groups, ^^ p ≤ 0.01 between groups, ^^^ p ≤ 0.001 between groups

All variables except age and Metabolic Syndrome Markers corrected for age and sex. Statistical analyses were performed by general linear model using SYSTAT 12.

Post hoc analysis was performed using Tukey's Honestly-Significant-Difference Test. Statistical significance was set at p ≤ .05.
Pulmonary Function Studies

Baseline values for the percent predicted value of FEV₁ (∑₁FEV₁) and the percent predicted value of PEF (∑₁PEF) were not different between groups. No differences were found between or within groups at 12 months in either ∑₁FEV₁ or ∑₁PEF. At 24 months, the mean self-reported ∑₁FEV₁ in the I group was greater than that of the C group (99.1 ± 2.2%, 88.8 ± 2.6 %, p = 0.024), and the mean self-reported ∑₁PEF was not different between groups. No within-group differences were found in either self-reported ∑₁FEV₁ or ∑₁PEF at 24 months. No differences between groups or within groups were noted in diurnal variation in FEV₁ at 12 or 24 months.

At the study exit, the researcher-observed ∑₁PEF of the C group was lower than in the I group, but, was not significantly different (73.2 ± 6.1%, 81.5 ± 5.3% . p = 0.1). The researcher-observed ∑₁FEV₁ was not different between groups. The self reported pulmonary values of the combined cohorts (all participants) were correlated to those measured by the researcher at study exit. (Table 1.4). Complete pulmonary function test results can be found in the Appendix.

Correlations among clinical findings

During years one and two, WC correlated significantly with hsCRP, r = 0.56 (year one); r = 0.50 (year two) p < 0.001. In year one, hsCRP also was found to correlate with LDL-C r = 0.31 p = 0.004 and WC correlated negatively with HDL-C, r = -0.33. p = < 0.001.
Table 1.4 Correlation of Self-reported with Researcher-observed Exit Pulmonary Function Tests

<table>
<thead>
<tr>
<th>Variable pairs</th>
<th>r</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV1 Self-reported</td>
<td>FEV1 Exit</td>
<td>0.659</td>
</tr>
<tr>
<td>PEF Self-reported</td>
<td>PEF Exit</td>
<td>0.699</td>
</tr>
<tr>
<td>% PRED FEV1 Self-reported</td>
<td>% PRED FEV1 Exit</td>
<td>0.761</td>
</tr>
<tr>
<td>% PRED PEF Self-reported</td>
<td>% PRED PEF Exit</td>
<td>0.752</td>
</tr>
</tbody>
</table>

FEV1 – forced expiratory volume in 1 second, PEF – Peak expiratory flow rate
% PRED FEV1, % PRED PEF - Test values were compared to predicted normal values for PEF (49) and FEV1 (50); Percent of predicted = (measured PEF or FEV1) / (predicted PEF or FEV1) * 10
Self-reported = test values reported by participants at 24 months, Exit = values of investigator-observed tests at study exit.
Statistical significance was set at p ≤ 0.05

Diet Analysis

Baseline, 12 and 24 month analyses. At baseline, the percent of unspecified dietary fats consumed was significantly greater in the I group than the C group (9.4%, 7.0%, p = 0.02). No other between-group differences in nutrient consumption were noted.

At 12 months, the n-6/n-3 ratio of the C group was found to be greater than that of the I group (14.49 ±1.8; 10.33 ± 2.3, p = 0.03). (Figure 1.2). There were no other differences found between groups in any nutrient. No significant differences in nutrient intakes were found in the 24 month diet analysis. However, at 24 months, n-6 fatty acids consumption of C group tended to be higher than I group (p = 0.09).
Analyses by year. In year one, energy intake from baseline decreased in the C group (1893.4 ± 68.6 kcals; 1629.06 ± 84.9 kcals, p = 0.019) and the I group (1881.7 ± 89.1 kcals, 1485.05 ± 110.5 kcals, p = 0.001) The I group also reported a decrease in percent of unspecified dietary fats from baseline levels (8.0% ± 0.6% to 5.96% ± 0.8%, p = 0.033) (Figure 1.3), as well as grams of carbohydrates (249.38 ± 13.4 gms to 196.19 ± 16.8 gms, p = 0.006), and iron (16.21 ± 1.1 mg to 11.94 ± 1.4 mg, p = 0.01), data are presented in the Appendix. No other within-group differences were noted; and no between group differences were found in any nutrient in year one. In Year two, there were no within-group or between group differences found in any nutrient from 12 to 24 months.
In the subset of diet records analyzed for MyPyramid food groups servings, a decrease in the percent of recommended grain consumption from baseline levels was reported in the I group (99.77% ± 16.4%, 53.82% ± 16.6%, \( p = 0.039 \)). No other within-group differences were noted in either group and no between-group differences were found for any food group.

**Dietary changes and clinical measurements correlations.** Multiple regression analyses were used to determine which, if any, of the anthropometric and dietary changes observed during the intervention year one could explain the changes in LDL-C from baseline in the I group. It was found that two factors, dietary n-6/n-3 fatty acids and changes in percent body fat explained 41% of the variance in the change in LDL-C (\( R^2 = 0.41 \), \( f(2,25) = 8.58, p = 0.001 \)). For
dietary n-6/n-3 ratio, intake correlated inversely; i.e., the greater the reduction in the ratio of n-6 to n-3 fatty acids, the greater the improvement in LDL-C concentration in year one \( (r = -0.51, p = 0.003) \). For PCTFM, the correlation was positive \( (r = 0.42, p = 0.011) \) with the change in LDL-C. (Figures 1.4A and 1.4B). Furthermore, in year one, grams of dietary n-6 fatty acids positively correlated with grams of dietary saturated fatty acids \( (r = 0.42, p = 0.024) \) and grams of dietary fiber consumption correlated negatively with WC \( (r = -0.29, p = 0.03) \). Complete Diet Analyses results can be found in Tables 1.5 and 1.6.
Figure 1.4 Correlations of Year One Change in LDL-C and Dietary and Anthropometric Variables

A. Correlation of Year One Dietary Omega Fatty Acid Ratio with the Change in LDL-C

B. Correlation of the Year One Change in Body Fat Mass with the Change in LDL-C

\[ V_i \text{ Comparison} \times \text{Intervention} \]

\[ N \text{Comparison} \times \text{Intervention} \]

Fig. 1.3A Dietary n-6/n-3 ratio intake correlated inversely, i.e., the greater the reduction in the ratio of n-6 to n-3 fatty acids, the greater the improvement in LDL-C concentration in year one (r = -0.51, p = 0.003). Figure 1.3B Decrease in percent body fat correlated positively with the change in LDL-C (r = 0.42, p = 0.011). Statistical significance was set at p ≤ 0.05.
Table 1.5 Year 1 Diet Analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Comparison</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline (n = 22)</td>
<td>12 months (n = 18)</td>
</tr>
<tr>
<td>Carbohydrate ( % of kcals)</td>
<td>48.2 ± 2.1</td>
<td>49.1 ± 2.4</td>
</tr>
<tr>
<td>Protein ( % of kcals)</td>
<td>16.3 ± 1.3</td>
<td>17.7 ± 1.4</td>
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<tr>
<td>Fat ( % of kcals)</td>
<td>34.2 ± 1.8</td>
<td>33.3 ± 2.0</td>
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<tr>
<td>Saturated fat ( % of kcals)</td>
<td>11.5 ± 0.8</td>
<td>11.0 ± 1.0</td>
</tr>
<tr>
<td>Monounsaturated fat ( % of kcals)</td>
<td>9.5 ± 2.0</td>
<td>13.0 ± 2.3</td>
</tr>
<tr>
<td>Polyunsaturated fat ( % of kcals)</td>
<td>5.6 ± 0.5</td>
<td>6.4 ± 0.6</td>
</tr>
<tr>
<td>Unspecified fats ( % of kcals)</td>
<td>7.1 ± 0.5</td>
<td>6.6 ± 0.6</td>
</tr>
<tr>
<td>Energy (kcals)</td>
<td>1893.4 ± 68.6</td>
<td>1629.1 ± 84.9*</td>
</tr>
<tr>
<td>CHO (gms)</td>
<td>247.6 ± 10.5</td>
<td>221.8 ± 12.9</td>
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<tr>
<td>Fat (gms)</td>
<td>74.8 ± 6.8</td>
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<tr>
<td>Protein (gms)</td>
<td>78.2 ± 3.3</td>
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<tr>
<td>Saturated fat (gms)</td>
<td>28.0 ± 2.4</td>
<td>26.5 ± 2.7</td>
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<tr>
<td>Monounsaturated fat (gms)</td>
<td>26.0 ± 2.2</td>
<td>22.8 ± 2.5</td>
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<tr>
<td>Polyunsaturated fat (gms)</td>
<td>13.1 ± 1.3</td>
<td>14.4 ± 1.4</td>
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<tr>
<td>Cholesterol (mg)</td>
<td>316.0 ± 30.6</td>
<td>299.6 ± 35.0</td>
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<tr>
<td>Omega-6 fatty acids (gms)</td>
<td>9.0 ± 1.0</td>
<td>10.5 ± 1.2</td>
</tr>
<tr>
<td>Omega-3 fatty acids (gms)</td>
<td>0.7 ± 0.2</td>
<td>0.8 ± 0.2</td>
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<tr>
<td>Omega-6 / Omega-3 ratio (n)</td>
<td>14.4 ± 1.4</td>
<td>15.3 ± 1.6</td>
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<tr>
<td>Fiber (gms)</td>
<td>24.5 ± 4.1</td>
<td>23.5 ± 1.7</td>
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<tr>
<td>Sugar (gms)</td>
<td>95.5 ± 6.4</td>
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<td>817.4 ± 93.3</td>
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<td>FE (gms)</td>
<td>16.0 ± 0.9</td>
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<td>Mg (gms)</td>
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<td>K (gms)</td>
<td>2579.6 ± 182.0</td>
<td>2495.6 ± 207.9</td>
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<tr>
<td>Zn (gms)</td>
<td>10.5 ± 1.0</td>
<td>9.5 ± 1.1</td>
</tr>
<tr>
<td>NA (gms)</td>
<td>3072.8 ± 196.3</td>
<td>3172.3 ± 224.3</td>
</tr>
</tbody>
</table>

* p ≤ 0.05 within group, ** p ≤ 0.01 within group, *** p ≤ 0.001 within group

Diet analysis was performed using Diet Analysis Plus 8.0 using 3-day self-reported diet record. All variables corrected for age and sex. Statistical analyses were performed by general linear model using SYSTAT 12. Post hoc analysis was performed using Tukey's Honestly-Significant-Difference Test. Statistical significance was set at p ≤ .05
<table>
<thead>
<tr>
<th>Variable</th>
<th>Comparison</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12 months (n = 18)</td>
<td>24 months (n = 17)</td>
</tr>
<tr>
<td>Carbohydrate (% of kcals)</td>
<td>50.0 ± 2.1</td>
<td>50.7 ± 2.1</td>
</tr>
<tr>
<td>Protein (% of kcals)</td>
<td>17.7 ± 1.5</td>
<td>16.1 ± 1.5</td>
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<tr>
<td>Fat (% of kcals)</td>
<td>31.6 ± 2.1</td>
<td>32.2 ± 2.2</td>
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<tr>
<td>Saturated fat (% of kcals)</td>
<td>10.7 ± 0.9</td>
<td>10.6 ± 0.9</td>
</tr>
<tr>
<td>Monounsaturated fat (% of kcals)</td>
<td>12.7 ± 3.0</td>
<td>7.5 ± 3.0</td>
</tr>
<tr>
<td>Polyunsaturated fat (% of kcals)</td>
<td>6.1 ± 0.7</td>
<td>5.3 ± 0.7</td>
</tr>
<tr>
<td>Unspecified fats (% of kcals)</td>
<td>7.1 ± 1.1</td>
<td>8.5 ± 1.1</td>
</tr>
<tr>
<td>Energy (kcals)</td>
<td>1888.5 ± 134.1</td>
<td>1971.6 ± 135.3</td>
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<tr>
<td>CHO (gms)</td>
<td>238.8 ± 18.3</td>
<td>257.5 ± 18.5</td>
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<tr>
<td>Protein (gms)</td>
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<td>79.4 ± 5.9</td>
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<tr>
<td>Saturated fat (gms)</td>
<td>23.3 ± 2.9</td>
<td>23.6 ± 2.9</td>
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<tr>
<td>Monounsaturated fat (gms)</td>
<td>14.6 ± 2.7</td>
<td>14.8 ± 2.7</td>
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<tr>
<td>Polyunsaturated fat (gms)</td>
<td>13.1 ± 1.5</td>
<td>11.8 ± 1.6</td>
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<tr>
<td>Cholesterol (mg)</td>
<td>257.3 ± 33.0</td>
<td>220.7 ± 33.3</td>
</tr>
<tr>
<td>Omega-6 fatty acids (gms)</td>
<td>9.6 ± 1.3</td>
<td>8.1 ± 1.3</td>
</tr>
<tr>
<td>Omega-3 fatty acids (gms)</td>
<td>0.8 ± 0.3</td>
<td>0.6 ± 0.3</td>
</tr>
<tr>
<td>Omega-6 / Omega-3 ratio (n)</td>
<td>15.0 ± 2.1</td>
<td>15.5 ± 2.2</td>
</tr>
<tr>
<td>Fiber (gms)</td>
<td>20.5 ± 5.4</td>
<td>27.9 ± 5.4</td>
</tr>
<tr>
<td>Sugar (gms)</td>
<td>87.3 ± 9.8</td>
<td>98.5 ± 10.0</td>
</tr>
<tr>
<td>CA (gms)</td>
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<td>964.3 ± 155.1</td>
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<tr>
<td>FE (gms)</td>
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<td>15.2 ± 2.2</td>
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<tr>
<td>Mg (gms)</td>
<td>254.4 ± 26.9</td>
<td>257.0 ± 27.1</td>
</tr>
<tr>
<td>K (gms)</td>
<td>2498.4 ± 185.9</td>
<td>2573.0 ± 188.7</td>
</tr>
<tr>
<td>Zn (gms)</td>
<td>8.6 ± 1.6</td>
<td>9.4 ± 1.7</td>
</tr>
<tr>
<td>NA (gms)</td>
<td>2795.2 ± 254.0</td>
<td>2847.6 ± 247.5</td>
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</table>

Diet analysis was performed using Diet Analysis Plus 8.0 using 3-day self-reported diet record. All variables corrected for age and sex. Statistical analyses were performed by general linear model using SYSTAT 12. Post hoc analysis was performed using Tukey's Honestly-Significant-Difference Test. All variables NS between or within groups. Statistical significance was set at p ≤ .05.
**Intervention Step Counts**

Only female participants reported steps. Twenty participants reported baseline values. At the end of year one, the number of participants in the I group that reported steps was fourteen (54% of I group). A separate analysis at baseline and at each quarter found no significant differences in the mean number of steps of those participants who reported steps for all four quarters, and those that did not.

During year one, average steps per day increased significantly from baseline (5253 ± 368 steps/day) by the second quarter, and continued at that level for the duration of the year (7149 ± 400 steps/day, p = 0.01). (Figure 1.5). At the end of year two, the number of reporting participants dropped to four. During year two, the average steps per day remained unchanged from the end of year one (7010 ± 367 steps/day). Complete Intervention step data can be found in the Appendix.

![Figure 1.5 Year One Average Intervention Group Steps per Day](image)

Within-group differences in steps/day at baseline and each quarter-year during year 1. Analyses were performed by General Linear Model and corrected for age. Data re presented as LSM ± SE. Only female participants reported steps. Statistical significance was set at p ≤ 0.05.
Discussion

Findings of the present study show that a WW program of monthly education sessions was effective in producing a decrease in TC and LDL-C in the I participants and preventing the increase in WC and MetS markers seen in the C participants in year one. Moreover, the quarterly education sessions in year two were sufficient to sustain the improvements in lipids seen in year one and promote additionally identified decreases in hsCRP and WC in the I group.

Lipid improvements

Having a high level of LDL-C is a major risk factor for CVD and the decrease of 8% in TC and 13% in LDL-C (from baseline and relative to the C group) found in the I participants of the present study suggests a reduction in CVD risk. Lifestyle modifications that include adjustment of dietary fat intake, increased physical activity and weight control can decrease LDL-C by up to 30% (13). Our finding of reduced LDL-C is consistent with previous investigations of lifestyle change that reported LDL-C reductions of 5% - 28% (54-56).

On the other hand, our results are in contrast to those referenced in a recent review by Groeneveld, et al. (57). In some cases of earlier worksite investigations, it was noted that either total or LDL cholesterol was not different from controls following an educational intervention. The educational interventions reviewed were aimed at improving lifestyle behaviors, although differed from each other and the present study in length of intervention; 12 weeks (58), 6 months (59), and 12 months (60). The study design in all of the aforementioned
studies, were somewhat similar to ours in that the interventions included enhanced educational components in addition to the screening with minimal information received by all study participants. However, the educational components varied widely in that they consisted of private counseling (61), four group sessions (59), or monthly individual sessions along with group classes (60). Additionally, two of the study populations were limited to individuals with elevated cholesterol levels (59, 60), and one to individuals diagnosed with angina (58). The differences in findings of the present study from those cited may have occurred due to the frequency, duration, style, or content of the interactive educational sessions. However, it is possible that the improvement seen among the I group in our study in total and LDL cholesterol might also be partially attributed to the health status of the study population. The subjects of the current study were not recruited or screened for the presence or absence of CVD risk factors, and were considered in relatively good health. This supports the interpretation that a WHP that promotes healthy lifestyle practices is a preventative effort that can help to preclude the hazard of modifiable disease among employees without previously identified risk factors.

**Waist Circumference and Metabolic Syndrome Markers**

Waist circumference is a surrogate measure of abdominal fat mass, and is independently associated with cardiometabolic disorders (62, 63). It is now understood that abdominal fat mass as measured by WC is a more significant risk factor for CVD than total adiposity, per se (64). Although the percentage total body fat mass was not found to be different between or within groups in the
present study, WC in the C group increased significantly in year one, and was larger yet at 24 months. In contrast, a non-significant decrease in WC of the I group resulted in a significant difference from the C group at 24 months.

We did not observe any statistical changes or differences in BMI or total fat mass either within or between groups. However, we did find that change in fat mass positively correlated with change in LDL-C at 12 months. In an international, cross sectional study of 69,409 men and 98,750 women, Balkau et al. found that there was a graded increase in the frequency of CVD with both BMI and WC, with a stronger relationship for WC than for BMI in both genders (65).

In the present study, the number of MetS markers in the I group remained unchanged from baseline to 24 months. This was in contrast to the C group, where the number of MetS markers increased in year one; were greater than in the I group, and remained elevated during year two. This is consistent with the findings of another study of a 12 month lifestyle intervention in dysmetabolic individuals that showed an increase in MetS components in the control group. Bo and Ciccone reported that metabolic deterioration in the intervention group of their study was prevented, in part, due to a decreasing WC and BMI (66). That study differs from ours in that the subjects received individually- prescribed diet and exercise recommendations. We also did not identify a decrease in BMI in our I group. However, sample size and insufficient statistical power could account for the dissimilarity in findings. The decrease of 0.29 Kg/M^2 in the BMI of the 169 intervention subjects in the aforementioned study was sufficient to be statistically
significant, while a decrease of 0.38 Kg/M² in the BMI of the 26 intervention group subjects in the present study was not.

The prevalence of MetS in adults is increasing and there is an abundance of evidence that individuals with MetS double their risk of CVD (6). In cross-sectional investigations of both a general population and a cohort at-risk for diabetes, the prevalence of the MetS increased with increasing age among women (67). Epidemiological research has shown that CVD mortality risk nearly doubles in those with even 1 or 2 MetS markers compared to those who have none (68).

The presence of MetS markers can indicate a general decline in wellness, or pre-disease, among employees. In a worksite study of over 5,000 employees, it was found that as the number of risk factors increased, there was an increase in absenteeism and illness days (69). In 2009, Schultz and Edington reported, that during the two-year span of their risk appraisal study of approximately 3300 manufacturing workers the prevalence of MetS increased. They also found that those employees with MetS were more likely to report new cases of heart disease, diabetes and other chronic diseases (70).

The impact of the intervention treatment on WC and MetS markers of the present two year investigation is noteworthy considering that the participants were relatively healthy and of similar age at the start; and were given only generalized lifestyle recommendations.
**Inflammation**

It is now recognized that inflammation is an important etiological element in MetS and CVD risk (71). In the present investigation, we found that hsCRP was reduced in the I group at 24 months from 12 months and less than that seen in the C group. In addition, WC and LDL-C were both positively correlated with hsCRP in our entire study cohort. This association is similar to the results of a cross-sectional study in men that investigated the relationship of hsCRP levels of a low or moderate range and determinants of MetS (72). That study showed a significant positive correlation between hsCRP, BMI and LDL-cholesterol among other indicators of MetS. A positive correlation between WC, markers of inflammation, as well as insulin resistance has been found in women with MetS (32). These findings suggest that a variety of components of the MetS are associated with elevated hsCRP levels in both genders.

The crucial mediators of metabolic syndrome and obesity-related inflammation have been identified as a complex set of chemical messengers that reside in the abdominal depot of total adipose tissue (73). Recent investigations have provided evidence that a reduction in markers of inflammation and insulin resistance occurs following weight loss. A review of 33 weight-loss intervention studies that reported measuring CRP found that, in all studies, weight loss was linked in a linear fashion decline in CRP level (74). In a separate study, CRP was decreased and insulin sensitivity improved following weight loss and a reduced waist-to-hip ratio in 60 obese women over two years (75).


**Pulmonary Function Tests**

Reduced pulmonary function has been associated with increased body fat mass, cardiovascular disease; and it has been shown to predict the development of insulin resistance (45, 76, 77). Interestingly, increased WC (a risk factor of insulin resistance) and not BMI, has been found to be negatively associated with pulmonary function in normal weight, overweight and obese subjects (46). Given these links, our study sought to identify a relationship between indices of abdominal obesity and pulmonary function. In the present investigation we did not observe a significant relationship between WC or the markers of MetS and pulmonary function.

However, it was noted at 24 months that the self-reported percent of predicted FEV₁ was greater in the I than in the C group. The test means of both groups at that time were above the specified cut-off predicted value (80%) thereby indicating normal pulmonary function in both cases (78). The results of the observed testing performed by the study investigator during the Exit testing were somewhat different, but correlated closely to those that were self-reported by the participants at 24 months. Investigator observed testing of 91% of all participants at the end of the study resulted in measures similar to those of the self-reported tests, but were not significantly different between groups.

In a randomized sample of 2,153 men and women aged 35 – 79 years, it was found that the percent predicted FEV₁ was inversely associated with WC in both men and women (79). It should be noted that in the above study, the relatively small differences in percent predicted FEV₁ were found across four
quartiles of WC, for both men and women. Our return rate of airway test measurements from participants was poor at 12 and 24 months (15% and 40%, respectively). It is likely that the number of reports at 12 months, coupled with a small subject pool, did not provide enough statistical power to identify differences, trends, or associations, if present.

**Dietary pattern link to inflammation**

Dietary changes that occurred in the I group of the current investigation indicated a modification in fat intake that is associated with reduced CVD risk and inflammation. At the end of year one, the I group reported a decrease in intake of fats that were categorized by the diet analysis software to include trans fats. In addition, the intake of dietary n-6 to n-3 fatty acid ratio was less in the I group than the C group, and the n-6 to n-3 ratio was a significant predictor of the decrease in LDL-C that occurred in year one. Further analysis showed that intake of n-6 fatty acid intake was correlated directly with saturated fat consumption. At 24 months, intake of n-6 fatty acids was greater among C than I group. In year two, hsCRP was found to significantly increase within C group and WC was found to be greater than I group at 24 months.

According to the American Heart Association Nutrition Committee, multiple dietary factors influence CVD risk, but, the most influential factors in LDL-C concentrations are saturated and trans fatty acid intakes (80). In a clinical trial of varying levels of trans fat consumption, the diet with the lowest concentration of trans fat was associated with a reduced LDL-C of 12% (81), a result that is consistent with the 13% relative reduction in LDL-C seen in the present study.
We did not measure any differences in the consumption of saturated fats. However in year one, the correlation of dietary n-6 fatty acids with saturated fat intake in our study suggests higher a consumption of saturated fats in participants who also consumed higher amounts of n-6 fatty acids. This finding could infer that the C group intake of saturated fats was, on the whole, higher than of the I group due to their higher n-6 to n-3 fatty acid ratio at 12 months and a higher n-6 fatty acid intake at 24 months.

In addition to the negative impact that \textit{trans} fatty acids have on LDL-C concentrations, there is evidence that they are also linked to inflammation. In a cross-sectional examination of data from relatively healthy women from the Nurse's Healthy Study cohort, it was found that CRP levels were 73\% higher among those that had the highest \textit{trans} fatty acid intake (82). On the other hand, dietary strategies that include n-3 fatty acids, reduced \textit{trans} and saturated fats are associated with reduced inflammation (83).

The ratio of dietary n-6 to n-3 fatty acid intake also is linked to inflammation. A recent review suggests that the two families of polyunsaturated fatty acids (PUFAs) appear to have reciprocal effects on inflammation; n-3 fatty acids being anti-inflammatory, while n-6 fatty acids are proinflammatory (83). Consistent with the results of the present investigation, Guebre-Egziabher, et al. found that a reduced n-6 to n-3 ratio achieved with simple dietary counseling, was sufficient to attain significant reductions in LDL-C and inflammatory proteins (84). Similarly, a 2 year clinical trial of otherwise healthy obese women who
reduced dietary energy, saturated fat, and had a lower ratio of n-6 to n-3 fatty acids than control subjects, reduced CRP (75).

The physiological response to dietary changes intended to reduce inflammation may differ based on the degree of adiposity. A cross-sectional study of overweight and lean subjects found that dietary n-3 fatty acids were correlated negatively with CRP; and n-6 fatty acids were correlated negatively with another inflammatory marker, IL-6, but only in the overweight group (85). These findings are somewhat different with those of another study of a non-overweight population that reported an inverse association of both plasma n-6 and n-3 fatty acids with both CRP and IL-6, but a strong positive relationship to both markers with the ratio of n-6 to n-3 fatty acids (86). The results of the present investigation suggest that the metabolic profile of the C group (CRP and WC greater than that of the I group) was associated with a higher consumption of n-6 to n-3 fatty acid ratio than the I group.

**Physical Activity**

Reductions in cholesterol (87), components of MetS (88), adiposity (89), and CRP (90) have been linked to physical activity by using pedometer-determined walking. Gregg, et al. found that diabetics who walked at least 2 hours per week had reduced CVD mortality rate by 34 percent compared with inactive individuals (91). In addition, multiple studies report that there is a linear relationship in observed changes in clinical variables such as BMI, WC, components of MetS (92, 93) and body fat (88) to the number of steps walked daily. At 12 months, the I participants reported a mean of 6878 ± 456 steps/day,
although, they were encouraged to walk 10,000 steps/day. Alternatively, it was strongly suggested that they increase their daily step count from baseline or participate in other regular, aerobic activity. According to Tudor-Locke and Bassett, while 10,000 steps/day appears to be a reasonable estimate of daily activity for apparently healthy adults, health benefits of activity and its sustainability may be more related to incremental improvements relative to baseline values (53). Step data for year one in the present study indicated that 50% of the I group increased daily step counts significantly by 30% daily compared to baseline; and maintained that activity level during year one.

The present findings are similar to the mean increase of 2183 steps/day reported in a 2007 review of 18 observational studies (mean duration 18 weeks) of pedometer use, physical activity and health outcomes (94). Since the overall mean improvement in pedometer-measured physical activity in that review increased by 26.9%, our results are, at least, comparable.

It is noteworthy that the mean steps/day did not decrease from 12 to 24 months. However, there was a reduction in the reporting of steps/day to 20% of the I group over the span of 24 months. However, this is not inconsistent with other observations. Pettman et al, compared their attrition and reporting statistics to other lifestyle interventions. They found that the expected adherence to exercise would be, on average, 50% (95). Hence, the compliance rate of 50% in the first year of our study appears to be acceptable. Interestingly, 69% of the I group reported step data for at least 13 weeks. Our compliance rate was similar to that of another study whose authors maintain that interventions of duration
longer than four months tend to have greater attrition. In their study, the 69% attendance at exercise sessions achieved at four months was reduced to 50% after the fourth month (96).

**Limitations and Strengths**

Limitations of this study include the reliance on self-reported information for diet, physical activity and pulmonary function. It is not likely that the decreased energy intake reported by our study participants accurately reflected their usual consumption, since there was no corresponding decrease in body weight found. Underreporting of energy intakes in diet records is common, even when the subjects or clients have been educated in how to estimate portion sizes and to include all food and beverages (96-98). Although misreporting may have occurred in both the C and I groups, the differences found in fat consumption were expressed in ratios and percentage of total intake, rather than absolute amounts of nutrients. Therefore true accuracy of intake would have been affected less due to underreporting. In another worksite intervention study designed to reduce the risk of CVD, the authors concluded that since the misreporting of dietary information occurred in both groups that bias was not introduced (99).

It is possible to detect misreporting of energy intake in weight-stable individuals by the estimation of resting energy expenditure of the individual or empirically by using a laboratory method such as doubly labeled water (100). Such a method should be considered in future studies. It is also possible that there were associations between dietary factors and clinical measurements that were missed due to a loss of statistical power. At 12 months, there was a return
of only 56% of diet records while baseline and 24 month diet records were
returned at a rate of 72% and 81%, respectively. However, other studies have
reported diet record return rates as low as 33% (95). Taken together, we would
argue that underreporting did not diminish the impact of the relationships we
have described herein between dietary factors and clinical measurements.

The burden of reporting physical activity over such a long period of time
(i.e. 24 months) may have only reduced compliance with self-reporting, rather
than reduced physical activity, per se. Support for this possible interpretation is
suggested from results of responses to the Exit Survey in which the study
participants reported that more of the I group than the C group increased
physical activity (data in Chapter 3), and the sustained clinical improvements
measured in the I group over 24 months.

The usefulness of a hand-held spirometer to detect changes in relatively
healthy individuals may also be limited due to respondent burden. This
assumption is in accordance with the findings of others who report high
withdrawal rates, falsified values and poor adherence in investigations of the
accuracy of self-monitoring PEF measurements (101-103). Moreover, a known
limitation to pulmonary function is that many asthmatics have normal tests
between episodes (104).

It is possible that medication use in the few participants with diagnosed
asthma (4 at baseline, 3 at 24 months) confounded our results. However, both
the self-reported diagnosis and reported use of medications were entered into
the statistical model as covariates to account for their affect. Furthermore,
instructions for the measurements included the qualification that testing be conducted during a week without a cold or other respiratory ailment. It is possible that the use of a self-recording spirometer might reduce participant burden and provide better compliance in any future investigation.

It is possible that self-selection bias among participants occurred, since individuals who were more motivated to make lifestyle changes may have been more likely to volunteer. Also, our experimental design did not include a true randomized control group. C group participants were exposed in the workplace to the I group participants and could have emulated physical activities or dietary patterns learned by observation.

Because all participants received their test results and newsletters, undesirable results may have prompted private interventions outside of the research protocol, such as clinic visits and external health or fitness programs. It was beyond the scope of the study to control for outside influences that would modify behaviors. Another limitation of this study was that the sample size was small; however, participation rate was 35% of employees.

A strength of our study was the implementation of videoconferencing to deliver simultaneous educational videoconferences, in different worksites of a decentralized organization. Moreover, access to the videoconferences could be broadened. For example, educational sessions might be viewed on personal desktop computers at work, as the most up-to-date software allows for remote internet viewing and archiving for later viewing. The use of technology can help to ease concerns about high costs and accessibility.
Because a small organization limits the potential pool of participants, our study protocol did not exclude any volunteers according to the presence or absence of preexisting risk factors. Analysis of baseline characteristics, however, showed the population to be relatively healthy with no differences between groups in measures of CHD risk. It could be argued that the impact of our results is increased and could be generalized to a typical employee population.

**Summary / Conclusions**

As a result of participation in a WHP, the I group achieved a reduction in total and LDL cholesterol, thereby reducing risk for cardiometabolic disease in year one. During that year, an increase in WC and MetS markers occurred in the C group and was avoided in the I group.

Dietary results in year one reinforce the conclusion that the I group modified diet in a healthful manner by decreasing total and unspecified (primarily *trans*) fats as well as consuming a ratio of omega-6 to omega-3 fatty acids that was less than that of the C group. This is a beneficial outcome because both the amount and class of dietary fats can influence the metabolic profile.

The assertion that a favorable impact on lifestyle occurred is supported by the increased step activity, increased exercise, improved diet and lifestyle reported by the I group. The I group subjects reported making more lifestyle and health changes overall relative to the C group.

Changes that occurred in year one of the WHP were sustained during year two, a period of less frequent educational sessions. Intervention education
that persisted throughout year two may have reinforced the need for healthy changes, or identified new changes that needed to be made since educational material varied from year one to year two. In addition, differences in WC and CRP that occurred at 24 months between groups may reflect that additional, small changes occurred over time and contributed to the prevention of changes that occur with aging.
Introduction

Chronic diseases are leading causes of death and increasing in prevalence. These conditions are linked to modern lifestyle (1); however, lifestyle modifications can avert these disorders (2). These conditions are predictable if risk factors are identified; therefore, they are also preventable (3).

Elevated blood low-density lipoprotein cholesterol (LDL-C) is a risk factor that is associated with coronary heart disease (CHD), frequently coexists with metabolic syndrome (MetS) and is the principal target for CHD risk reduction (3). Studies indicate that there is a reduction in CHD risk of at least 1% for every 1% reduction in LDL-C (4-6).

Investigators have maintained and shown that worksites are uniquely positioned to provide health promotion that successfully reduces risk for the development of chronic disease in employees (7-9). Employers are concerned about financial outlay for health costs that include medical plan contributions, sick leave, disability and worker’s compensation costs (10). Employees with modifiable lifestyle risk factors cost employers 228% more in health costs than
risk-free employees (11). However, costs and absenteeism are decreased when employee's health risks are reduced through worksite programs (12). A meta-analysis of studies on cost-savings associated with such programs showed that the average annual employer cost of $144 per employee represented a cost-savings of $358 per participant in 2009 dollars (13). Most of the studies evaluated were implemented in companies with more than 1,000 employees and were centralized; it is not clear if these findings can be generalized to smaller organizations. Since firms with fewer than 500 employees represent 99.7% of U.S. employers, more efforts to promote workplace wellness programs and reduce perceived barriers of affordability are warranted. In particular, development of programs that are affordable for small businesses is needed (14).

The purpose of the following study was to evaluate whether a worksite health promotion (WHP) improves health risk factors in employees and is cost-effective to the employer of an organization that is small in size and is decentralized.

**Methods**

For a detailed description of methods, see Chapter 1.

Cost-effectiveness ratios in the present study are presented from the perspective of the employer and are based on data from year 1 of the investigation. Costs are reported as direct employer costs in 2006 dollars. Costs for the intervention include compensation for the author to present the
educational material and administer the program, facilitation of remote site food demonstrations and teleconferencing services (includes scheduling and technologist support). Cost of the intervention was measured as the per-capita cost for the intervention (I) group. Per capita costs for health screening for both the I group and the comparison (C) group were equal and are not included in the cost-effectiveness calculation and no costs for material development are included. Relative percentage point reduction, in the key marker, LDL-C, was used as the primary measure of efficacy. A secondary effectiveness outcome measure was the absolute change in CHD risk ($\Delta$CHD risk).

Computation of relative and absolute changes in LDL-C and CHD risk was based on the calculations of Soler et al., in their 2010 review of the effectiveness of worksite health interventions (15)(See Chapter 1).

The ten-year risk for the development of CHD was calculated using the Framingham Risk Score (FRS) and reported as a percentage. The FRS is an established formula that uses the measured risk factors: age, TC, HDL-C, SBP, treatment for hypertension, and cigarette smoking and is a well-accepted tool for health professionals (16). Risk was evaluated as follows: low risk = < 10%, intermediate risk = $\geq$ 10% and < 20%, and high risk = $\geq$ 20% (17).
Results

A detailed description of clinical results is presented in Chapter 1.

At 12 months, LDL-C was significantly less in the I group than the C group (110.86 ± 4.4 mg/dl, 126.67 ± 4.0 mg/dl respectively, p = 0.011) and approached significance from the baseline value (p = 0.06) a relative decrease of 13.4%.

LDL-C was not different at 12 months from baseline in the C group. TC in the I group decreased significantly from baseline to a value that was also significantly less than that found in the C group at 12 months (183.4 ± 4.4 mg/dl, 198.6 mg/dl, respectively, p = 0.001 within group, 0.013 between groups). TC in the C group was not different from baseline at the end of one year. The mean WC of the C group increased significantly from baseline, (98.8 ±1.0 cm, p= 0.001); there was no change from baseline in the mean WC among the I group. No other within-group or between-group differences in weight, BMI, PCTFM, TBWPCT, SBP, DBP, HDL-C, TC/HDL, TRG, FG or hsCRP were found.

Chi-square analysis of the FRS score of the C and I group at 12 months (1.8 ± 0.5, 1.9 ± 0.5) showed no significant between-group or within-group differences from baseline. However, the absolute reduction in CHD risk of the I group was 0.3 percentage points, a relative improvement of 18% in a population estimated to be low-risk at baseline. The results of health screening tests are shown in Table 1.3, Chapter 1.

Direct employer cost for the Intervention was $136.27 per participant in 2006. (Table 2.1). Cost effectiveness of the Intervention was $10.17 per
percentage point reduction in LDL-C and $454.23 per point reduction in CHD risk. (Table 2.2).

Table 2.1 Per capita cost ($) for one year University of New Hampshire Cooperative Extension Worksite Health Promotion for Intervention participants

<table>
<thead>
<tr>
<th>INTERVENTION EDUCATION</th>
<th>Cost ($)(^{a})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Videoconferencing(^{b})</td>
<td>35.00</td>
</tr>
<tr>
<td>Wellness program manager(^{c})</td>
<td>58.33</td>
</tr>
<tr>
<td>Remote site coordination(^{d})</td>
<td>10.00</td>
</tr>
<tr>
<td>Pedometers</td>
<td>32.94</td>
</tr>
<tr>
<td><strong>COST FOR INTERVENTION</strong></td>
<td><strong>136.27</strong></td>
</tr>
</tbody>
</table>

\(^{a}\)2006 dollars  
\(^{b}\)Videoconferencing includes scheduling and technical support  
\(^{c}\)Wellness educator (35 hrs - delivery of program, communication with participants and administration time)  
\(^{d}\)Administration, food demonstrations

Table 2.2 Comparison of cost-effectiveness ratios for one year UNH Cooperative Extension Workplace Health Promotion (WHP) with cited references

<table>
<thead>
<tr>
<th>Measure of Effectiveness</th>
<th>UNH WHP C-E Ratio</th>
<th>Reference</th>
<th>Reference C-E Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDL-C</td>
<td>$10.17 per relative % point reduction</td>
<td>Economic analysis of Killilea and Funk (18)</td>
<td>$12 to $19 per relative % point reduction</td>
</tr>
<tr>
<td>CHD Risk</td>
<td>$454.23 per absolute point reduction</td>
<td>Intervention study by Finkelstein, et al. (19)</td>
<td>$470 per absolute point reduction</td>
</tr>
</tbody>
</table>

C-E ratio = cost-effectiveness ratio, LDL-C = Low density lipoprotein cholesterol  
CHD Risk = the ten-year risk for the development of CHD using the Framingham Risk Score (16)
Discussion

Findings of the present study show that a worksite healthy lifestyle program can reduce the CHD risk factor LDL-C by 13%. Substantial evidence exists that reduction of LDL-C also reduces the risk of heart disease (6). The calculated 1.4% CHD risk reduction per percentage point reduction in LDL-C achieved in the present investigation is comparable to that of other studies that identified the CHD risk-reduction benefit achieved per unit of LDL-C reduction (20).

Since the consequence of the failure to prevent disease is often treatment, economic comparisons of this study are made in relation to both pharmaceutical and lifestyle interventions. HMG-CoA reductase inhibitor drugs (statins) have been established as agents for preventing CHD through LDL-C reduction. Although lifestyle interventions and pharmaceutical management of hyperlipidemia are both utilized for the primary prevention of CHD, it is believed that the most cost-effective means to curb CHD risk are lifestyle changes (6). Evidence that lifestyle changes are more cost-effective than drug treatment for LDL-C reduction is supported by the calculated C-E ratio of $10.17 per one percent reduction in LDL-C found in the present investigation. This compares favorably with the $12 - $19 per percent LDL-C reduction reported for statin treatments (18).

Finklestein et al. have published results of the on-going, multi-centered, study WISEWOMAN (21). These authors reported a C-E ratio related to changes in CHD risk of $470 per point reduction in the ten-year CHD risk for the wellness
intervention (19). The C-E ratio of the present study was $454.23 per point reduction in CHD risk. Because WISEWOMAN examined the differences between a health screening group and a screening group plus educational intervention in CHD risk reduction, it is a suitable cost-effectiveness comparison with the present findings. The investigators of WISEWOMAN reported that the program is a cost-effective approach for reducing CHD risk (19). Therefore, it can be claimed that the currently reported program is cost-effective as well.

The primary component of this intervention program was the educational sessions delivered by videoconferencing simultaneously, to different worksites of a decentralized organization. Delivery of the lifestyle education accounted for most of the expense of the intervention and amounted to $103.33 per participant. Potentially, this cost could be less per capita, since additional videoconference attendees add no cost. Moreover, access to the video conference could be broadened. Different types of workplaces and organizational structures may require flexible arrangements for the delivery of wellness education, particularly if the organization is small and decentralized. For example, live educational sessions might be viewed on personal desktop computers at work, as the most up-to-date software allows for remote internet viewing and archiving for later viewing. The use of technology can help to ease concerns about high costs and accessibility.

Limitations of the present study include the possibility that undesirable results prompted private interventions outside of the research protocol, as all participants were made aware of their testing results and received health
newsletters. It was beyond the scope of the study to control for outside influences that would modify behaviors. However, no differences were reported in the use of prescription medications from baseline at 12 months in either group. Another limitation was that our sample size was relatively small and not selected for the presence or absence of pre-existing risk factors. It was the intent of the investigation to recruit the employees of a small organization which limited the potential subject pool. However, participation was 35% of employees; and analysis of baseline characteristics between groups indicated no differences in measures of CHD risk, including medication use. On the other hand, it could be argued that the unselected subject population strengthens the impact of the present results in that they reflect a typical employee population, which increases the generalizability of the findings. Because specific lifestyle changes associated with the improved LDL-C found in the I group of this study were not identified, future studies might include design methodologies that quantify lifestyle characteristics in a way that is standardized and comparable to other investigations.

**Conclusions**

Findings of the present study demonstrate that LDL-C and overall CHD risk can be reduced in a relatively healthy employee group following health screening and lifestyle education. The expense of a healthy lifestyle intervention delivered at the worksite by videoconference is cost-effective, when compared to the pharmaceutical option of statin administration, or lifestyle education in a clinical setting.
A workplace health promotion program with an educational component delivered by videoconference can be a cost-effective method of supporting change that will translate into overall health and cost benefits for both employers and employees. If employers and employees can successfully participate in programs designed to improve the health of employees, at reasonable cost, both parties will benefit.
CHAPTER 3: DIFFERENCES IN HEALTH PERCEPTIONS AND BEHAVIORAL CHANGES BETWEEN GROUPS PARTICIPATING IN A WORKSITE HEALTH PROMOTION

Introduction

Preventable chronic health problems such as cardiovascular disease (CVD), type II diabetes and metabolic syndrome are costly to society, individuals and to employers. Workplace Health Promotions (WHPs) are known to be effective in chronic disease risk reduction and can be implemented at reasonable cost, benefitting both the employer and employee (1). See Chapters 1 and 2.

Cooperative Extension is the federally-mandated outreach arm of the University of New Hampshire charged with bringing educational programs based on current research to the public, often free of charge. As a worksite, Extension is unique because it is decentralized, its offices spread geographically throughout the state, and is equipped to help local communities and business invest in good health (2). Nutrition, health care strategies, financial management, and workforce education (including WHP) are examples of outreach programs that might be offered by Extension (3).

Extension expertise meets public needs at the local level, and has utilized multi-dimensional strategies for educational outreach that include the innovative
use of technology (4). Extension professionals are both leaders and community members and are in a position to apply multifaceted approaches in promoting healthier lifestyles. Often the design of those programs incorporates research from more than one academic discipline. In addition to utilizing knowledge gained from nutrition and exercise science, healthy lifestyle promotion is guided by research on how people think and what influences their behavior (5).

There are many theoretical models of health behavior with the common underlying premise that several psychosocial characteristics contribute to lifestyle behaviors. (Table 3.1). Nutrition education, as it relates to health, does not espouse a singular health behavior change theory specific to the discipline. Components of multiple theories have been borrowed and applied to predict health behaviors. However, none of the current theoretical models fully predict behavior change; and, it has been suggested that combining compatible theories may therefore be the most effective approach in nutrition education as it relates to health (6). A review of the literature noted that many variables are common among key theories and that studies often use compatible variables from related theories (7). Self-efficacy (confidence), decisional balance (importance) and commitment are examples of variables that are measured to predict health behavior change (8).
Table 3.1 Health Behavior Theories Commonly Applied to Lifestyle Programs and Research

<table>
<thead>
<tr>
<th>Theoretical Model</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge-Attitude-Behavior (KAB)</td>
<td>The KAB model relies heavily on the concept that knowledge is not only essential but provides motivation and attitude to make positive health changes (6).</td>
</tr>
<tr>
<td>Health Belief Model (HBM)</td>
<td>HBM propose that health-related action is dependent on sufficient motivation to make health relevant, the belief that health risk is present, belief that a behavior change (if perceived barriers can be overcome) will reduce risk, and that the behavior change is achievable. The emphasis of the HBM is that a perceived threat is the motivating force; perceived benefits (less barriers) become incentives for behavior change (9).</td>
</tr>
<tr>
<td>Transtheoretical Model (TTM) / Stages of Change (SOC)</td>
<td>TTM aka SOC originated from analysis and integration of common processes that individuals use to make changes in behavior. This model proposes that health behavior change can be seen as a continuum based on an individual's readiness to change. This change is gradual and occurs through a series of stages: precontemplation, contemplation, preparation, action and maintenance. TTM suggests that self-efficacy and weighing the pros and cons of change are important mediators of change (10).</td>
</tr>
<tr>
<td>Social Cognitive Theory (SCT)</td>
<td>The SCT model of health behavior change assumes that knowledge of health risks and the related lifestyle habits create the precondition for behavior change. The central role of self-efficacy is considered a core determinant of effective action. Self-efficacy in this model differs from confidence in that it includes both an assertion of capability to engage a behavior (&quot;I can do this.&quot;) and the conviction that the behavior will occur (&quot;I can do this and I will do this.&quot;). Short-term attainable goals are stressed as tools for the incremental development of self-efficacy (11).</td>
</tr>
</tbody>
</table>


The aim of the present study was to evaluate whether or not there were differences in health perceptions and lifestyle behaviors after participation in a WHP between an intervention (I) group receiving group lifestyle education via
interactive teleconference plus e-mailed newsletter and a comparison (C) group receiving lifestyle education through e-mailed newsletter only.

Methods

Study participants were volunteers from the employees of UNH Cooperative Extension. All employees were screened at baseline, 12 months and 24 months for anthropometric, clinical, dietary and biochemical risk factors for CVD and metabolic syndrome and completed health questionnaires. In addition, participants completed an exit survey at 24 months. All participants received hard copies of their screening results as well as periodic newsletters related to healthy lifestyles via email. The primary component of the intervention was educational sessions that were interactive and delivered simultaneously across the state by videoconference technology. The I group also received pedometers and instructions to report the number of steps taken weekly. The principal sources of data used to determine the health perceptions and behaviors of the participants were a Health Questionnaire at baseline, 12 and 24 months, along with an Exit Survey at 24 months. Differences in health perceptions and behaviors were measured using the following variables: Importance, Readiness to Change, Confidence, Commitment and Barriers. (Table 3.2). These data were examined separately, and in some cases, analyzed relative to clinical outcomes such as waist circumference (WC). Interpretation of open-ended responses was tested for agreement among three raters using an online calculator developed specifically for use when multiple raters are not restricted in the number of codes.
that are assigned to a singular response. The free-marginal kappa (kfree) of 0.70 or above indicates adequate interrater agreement (12). (Table 3.3).

Table 3.2 UNHCE Workplace Health Promotion
Health Behavior and Perception Questionnaire Variables

<table>
<thead>
<tr>
<th>Definition given to participants: Lifestyle changes are changes to improve your health, such as adjusting your diet, increasing your physical activity, and changing health-related behaviors.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Variable</strong></td>
</tr>
<tr>
<td>1. Importance</td>
</tr>
<tr>
<td>2. Readiness to change</td>
</tr>
<tr>
<td>3. Confidence</td>
</tr>
<tr>
<td>4. Commitment</td>
</tr>
<tr>
<td>5. Barriers</td>
</tr>
</tbody>
</table>

Variables 1–3 were quantitative questions and answered on a scale of 0–10. Variables 4 and 5 were open-ended questions and analyzed according to category code of each response as well as by frequency counts; i.e., number of lifestyle change and number of barriers perceived.

Detailed descriptions of the Questionnaire, Exit Survey methods, teleconference educational sessions and statistical treatment of data can be found in Chapter 1 and the Appendix. Newsletters can be viewed on the enclosed CD.
Table 3.3 Interater Agreement ($K_{free}$)(13) for Open-ended Responses from UNHCE Workplace Health Promotion Exit Survey and Health Questionnaire

<table>
<thead>
<tr>
<th>$K_{free}^{1}$</th>
<th>Questionnaire Commitment and Barriers Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.82</td>
<td>What lifestyle changes would you be willing to make?</td>
</tr>
<tr>
<td>0.78</td>
<td>What things might make it hard for you to make lifestyle changes?</td>
</tr>
<tr>
<td>0.76</td>
<td>As a result of participating in the UNHCE Workplace Wellness program: What lifestyle changes (for example, healthy diet and activity choices, health maintenance and stress management) have you made? Please be specific.</td>
</tr>
<tr>
<td>0.83</td>
<td>As a result of participating in the UNHCE Workplace Wellness program: What health changes have you made? Please be specific.</td>
</tr>
<tr>
<td>0.68</td>
<td>Should UNHCE have a Workplace Wellness Program? Why or why not?</td>
</tr>
<tr>
<td>0.33</td>
<td>Please comment on the UNHCE Workplace Wellness program (what did you like; what did you dislike; do you have any suggestions for changes?</td>
</tr>
</tbody>
</table>

1. Values of kappa can range from -1.0 to 1.0, with -1.0 indicating perfect disagreement below chance, 0.0 indicating agreement equal to chance, and 1.0 indicating perfect agreement above chance. A rule of thumb is that a kappa of .70 or above indicates adequate interrater agreement.(12)

Results

Major clinical and dietary outcomes

At year one from baseline, WC and Mets markers (MetS) increased statistically in the C group; Total (TC) and LDL-cholesterol (LDL-C) decreased in the I group. The I group consumed a lower ratio of dietary omega-6 to omega-3 fatty acids than reported by the C group at 12 months. Additionally, the I group decreased their intake of unspecified fats from baseline, a group of dietary fats...
that includes trans fats. The I group participants also increased the average steps taken per day and maintained the level throughout the year. In year two, the changes in TC, LDL-C and MetS were sustained. A decrease in WC in the I group resulted in a significant difference from that of the C group at 24 months.

Complete results of anthropometric, clinical, dietary and biochemical tests are found in Chapter 1.

Health Questionnaire

At baseline, 18 of 31 C group (58.1%) and 20 of 29 I group (69%) completed questionnaires. At 12 months, questionnaires were completed by 16 of 29 C group (55%) and 14 of 26 I group (53%). At 24 months, 19 of 23 C group (78.3%) and 17 of 20 I group (85%) returned questionnaires. Seventy percent of the participants from each group who completed the entire 24 months of the WHP returned all three questionnaires, (16 of 23 C group, 14 of 20 I group).

No differences were seen between groups, at baseline, 12 months or 24 months in responses related to frequency of medical check-ups, out-of-pocket medical expenses, sick-day absences, medication use and consumption of dietary supplements.

Importance, readiness to change, confidence, and stress levels. There were no differences between or within groups found in the scaled responses (0 - 10) to queries of how important it is to make lifestyle changes, readiness to make lifestyle changes, confidence in ability to make changes or in level of stress in year one or in year two. (Table 3.4).
Table 3.4 Scaled Measures of Importance, Readiness to Change, Confidence and Stress

<table>
<thead>
<tr>
<th>Variable</th>
<th>Year 1</th>
<th></th>
<th>Year 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline 12 mos</td>
<td>Intervention Baseline 12 mos</td>
<td>Baseline 12 mos</td>
<td>Intervention Baseline 12 mos</td>
</tr>
<tr>
<td></td>
<td>(n = 24)</td>
<td>(n = 23)</td>
<td>(n = 19)</td>
<td>(n = 18)</td>
</tr>
<tr>
<td>Importance</td>
<td>8.0 ± 0.3</td>
<td>8.0 ± 0.3</td>
<td>8.5 ± 0.6</td>
<td>7.7 ± 0.6</td>
</tr>
<tr>
<td>Readiness to change</td>
<td>7.5 ± 0.3</td>
<td>7.9 ± 0.4</td>
<td>8.3 ± 0.6</td>
<td>7.6 ± 0.7</td>
</tr>
<tr>
<td>Confidence</td>
<td>6.7 ± 0.4</td>
<td>6.6 ± 0.4</td>
<td>7.6 ± 0.7</td>
<td>7.7 ± 0.8</td>
</tr>
<tr>
<td>Stress level</td>
<td>5.6 ± 0.4</td>
<td>5.4 ± 0.5</td>
<td>5.3 ± 0.8</td>
<td>5.4 ± 0.8</td>
</tr>
</tbody>
</table>

Least square means of quantitative Questionnaire variables in year 1 and year 2. General linear model performed using age and gender as covariates and post-hoc analyses were conducted using Tukey's Honestly Significant Difference test. The level of statistical significance was set at p ≤ 0.05. Between group and within group analyses are all NS. Data are presented as LSM ± SE on a scale from 0 - 10.

Commitment and Barriers. In response to the question "What lifestyle changes are you willing to make", no statistical differences in the in the number of lifestyle changes that participants would be willing to make were reported between groups or within groups during year one. At 24 months, the I group reported they were willing to make significantly more lifestyle changes than at 12 months (2.47 ± 0.2, 1.98 ± 0.2 respectively, p = 0.04) which was also more than the C group reported at 24 months (1.75 ± 0.2, p = 0.002). Chi square analysis of the individual response categories (none, consume healthier diet, increase or maintain exercise, both healthier diet and exercise) for this question at baseline, 12 month and 24 months showed no statistical differences between groups.

In response to the question "What things might make it hard for you to make lifestyle changes", no significant differences in the number of barriers to
making lifestyle changes were identified between or within groups. However, the number of barriers reported by the I group at 12 months (1.84 ± 0.2) trended higher than at baseline (p = 0.07), and higher than reported by the C group (p = 0.08) at 12 months. There were no differences seen in either group in year 2 or between groups at 24 months. Chi square analysis of the individual response categories (none, time conflicts, family, stress/illness) for this question at baseline, 12 months, and 24 months was not different between groups. The most frequent response given by both groups was “time conflicts” (C group 67%, I group 64%).

In response to the question “Has participation in UNH Cooperative Extension Workplace Wellness Study impacted your lifestyle (diet and activity choices, health maintenance and stress management)”, more I than C group reported “improved” (83% vs. 58%), a differences that approached significance at p = 0.09. Significantly fewer I group than C group participants (11 % vs. 42 %, p = 0.034) reported “no change”. Only one participant (I group) reported “worsened”, which was not significant between groups.

In response to the question “Has participation in UNH Cooperative Extension Workplace Wellness Study impacted your health”, no differences between groups were found. “Stayed the same” was the response of 37% of C and 33% of the I groups while “Improved” was reported by 58% of the C and 67% of the I groups. Only one respondent reported “Worsened” (I group) and this was not significantly different from C group.
In response to the question “Has participation in UNH Cooperative Extension Workplace Wellness Study impacted how you feel”, no differences between groups were found. “Stayed the same” was the response of 42% of C and 36% of the I group participants while “Improved” was reported by 58% of the C and 64% of the I group. No respondent reported “Worsened”.

**Exit Survey**

Exit Surveys at 24 months were completed by 17 of the 23 C participants (74%) and 18 of the 20 I participants (90%).

In response to the Exit question “As a result of participating in the UNHCE Workplace Wellness program: What lifestyle changes (for example, healthy diet and activity choices, health maintenance and stress management) have you made? Please be specific.”, significantly more of the I group than the C group participants reported increased physical activity (84.2% vs. 41.2 %, p = 0.007) and improved diet (63.2% vs. 29.4 %, p = 0.043). One-third of the I group reported increased health awareness (for example, “increased awareness of healthy diet or increased awareness of need for physical activity”) while no C group participants gave a similar response (33.3% vs. 0%, p = 0.17). Twenty-four percent of the C group reported making no specific lifestyle changes compared to zero percent of the I group giving this response (p = 0.025).

In response to the Exit question “As a result of participating in the UNHCE Workplace Wellness program: What health changes have you made? Please be
specific.

fifty percent of the C group reported making no specific health changes at all, compared to 16.7% of the I group (p = 0.04). (Figure 3.1A)

**Figure 3.1A. Lifestyle and Health Behavior Changes Reported in Exit Survey**

<table>
<thead>
<tr>
<th>Lifestyle and Health Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>No specific health changes</td>
</tr>
<tr>
<td>No specific lifestyle changes</td>
</tr>
<tr>
<td>Improved diet</td>
</tr>
<tr>
<td>Increased exercise</td>
</tr>
<tr>
<td>Increased health awareness</td>
</tr>
</tbody>
</table>

Significant differences between groups in response to Exit Questions regarding lifestyle and health changes made as a result of participation in the UNH Cooperative Extension Workplace Health Promotion. Pearson's Chi square analysis was used to examine category responses between groups. Data are presented as the percent of all responses within each group. The level of statistical significance was set at p ≤ 0.05.

In response to the Exit question "Should UNHCE have a Workplace Wellness Program? Why or why not", there were no differences between groups. Both groups gave a strongly positive response to the query (C group 83.3% vs. I group 88.9%). Two respondents in each group responded "maybe", and the single negative response was given by a C group participant. (Figure 3.1B). The most frequent reasons given were "positive impact on health" (C group 83.3%, I group 88.9%) and "positive effect on work environment" (C group 27.8%, I group 38.9%).
In response to the Exit question "Please comment on the UNHCE Workplace Wellness program (what did you like; what did you dislike; do you have any suggestions for changes)", unfavorable comments were more likely to be made by C group participants than I group participants (50% vs. 5.5%. p = 0.024) and favorable comments were more likely to be given by I group participants, although the large majority of subjects from both groups made at least one favorable remark (100%, I group vs. 75%, C group. P= 0.003). There were no strictly unfavorable comments. Many responses listed satisfaction with most or some of the program protocol and added what was disliked, for example, "I liked the monthly meetings and the information that was given. I didn't like keeping track of our activity." The I group was more likely to report liking some aspect of the study protocol (for instance, "Screenings were helpful with..."
immediate feedback” or “I liked the newsletters”) than the C group (83.3% vs. 50 
%, p = 0.038), while the C group was more likely to report disliking some clinical 
aspect such as “fingerstick” or “fasting” of the study protocol (50% vs. 11.1%, p = 
0.013).

**Correlations between clinical variables and questionnaire responses**

Multiple regression analyses were used to determine if any of the behavior 
variables during the intervention year one could explain changes in waist 
circumference or the number of lifestyle changes reported.

Regression analysis, using WC at 12 months as the dependent variable, 
showed that 68% of the variance of all participants could be predicted by three 
variables: CRP at 12 months (r = 0.53, p <0.001), intake of dietary unspecified 
fats at 12 months (r = -0.205, p = 0.1) and the reported confidence in one’s ability 
to make changes as reported at baseline (r = -0.49, p = 0.001). Regression 
analysis using the number of specific lifestyle changes reported by participants in 
the exit survey as the dependent variable showed that 15% of the variation found 
could be predicted by the reported confidence in ability to make changes at 24 
months (r= 0.0.39, p = 0.027).

Separate regression analyses were done for the C and I group data using WC at 
12 months as the dependent variable; independent variables were CRP at 12 
months, and these variables: importance of changing at 12 months, readiness to 
change at 12 months, and confidence at 12 months. In all cases, CRP was 
strongly and significantly correlated with WC at 12 months. In the C group,
importance \( r = -0.5, p = 0.002 \) and readiness to change \( r = -0.40, p = 0.02 \) were significantly correlated to WC; confidence \( r = -0.34, p = 0.06 \) was nearly significantly negatively correlated with WC at 12 months. In the I group, none of the three additional variables were significantly correlated with WC at 12 months. (Table 3.5). Additional regression analyses of data from each treatment group using WC at 24 months as the dependent variable, CRP at 24 months and confidence at 24 months as the independent variables were done. In both groups, confidence at 24 months was inversely related to WC at 24 months, but was only significant in the I group, and trending toward significance in the C group.

**Discussion**

**Relationship of health perceptions and behaviors to intervention and clinical outcomes**

The present study indicated that health perceptions and behaviors of participants in a WHP designed to reduce CVD risk were dissimilar between a comparison group receiving only minimal information in the form of e-mailed newsletters and an intervention group that also participated in a series of interactive educational sessions delivered by videoconference. We were able to identify an association of health perception variables with the clinical risk factor of waist circumference, as well as with a measure of behavior change (number of lifestyle changes made). In addition, the measure for commitment to change in the I group
Table 3.5 Regression Analyses Performed Separately by Treatment Group Using Waist Circumference at 12 Months as Dependent Variable

### Comparison

<table>
<thead>
<tr>
<th>R² = 0.76</th>
<th>N = 17</th>
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</thead>
<tbody>
<tr>
<td>Independent Variable</td>
<td>Std Coefficient</td>
<td>p</td>
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<tr>
<td>Constant</td>
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<td>&lt;0.00</td>
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<tr>
<td>CRP (12 mo)</td>
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<td>&lt;0.00</td>
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<tr>
<td>Importance (12 mo)</td>
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<td>0.002</td>
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### Intervention

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<tr>
<td>CRP (12 mo)</td>
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<td>0.004</td>
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<tr>
<td>Importance (12 mo)</td>
<td>0.27</td>
<td>0.17</td>
</tr>
</tbody>
</table>

### Comparison

<table>
<thead>
<tr>
<th>R² = 0.67</th>
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<tbody>
<tr>
<td>Independent Variable</td>
<td>Std Coefficient</td>
<td>p</td>
</tr>
<tr>
<td>Constant</td>
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<td>&lt;0.001</td>
</tr>
<tr>
<td>CRP (12 mo)</td>
<td>0.71</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Ready to Chg (12 mo)</td>
<td>-0.40</td>
<td>0.02</td>
</tr>
</tbody>
</table>

### Intervention

<table>
<thead>
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<tbody>
<tr>
<td>Independent Variable</td>
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<tr>
<td>CRP (12 mo)</td>
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### Comparison

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<td>p</td>
</tr>
<tr>
<td>Constant</td>
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<td>&lt;0.001</td>
</tr>
<tr>
<td>CRP (12 mo)</td>
<td>0.71</td>
<td>0.001</td>
</tr>
<tr>
<td>Confidence (12 mo)</td>
<td>-0.34</td>
<td>0.06</td>
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### Intervention

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<td>Independent Variable</td>
<td>Std Coefficient</td>
<td>p</td>
</tr>
<tr>
<td>Constant</td>
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<td>&lt;0.001</td>
</tr>
<tr>
<td>CRP (12 mo)</td>
<td>0.66</td>
<td>0.004</td>
</tr>
<tr>
<td>Confidence (12 mo)</td>
<td>0.054</td>
<td>0.79</td>
</tr>
</tbody>
</table>

Separate regression analyses of Comparison and Intervention groups using waist circumference at 12 months as the dependent variable. CRP, importance, readiness to change and confidence were used as independent variables. The level of statistical significance was set at p ≤ 0.05.

Increased during the study and was greater than in the C group at 24 months.

Intervention group participants reported increases in physical activity and improved diet, as well as greater health awareness as a result of study participation.
Behavior change that results in a healthier lifestyle is likely to result in a physiologic shift toward wellness that can be measured. We found an association between confidence in the ability to make changes and waist circumference, an important risk factor for CVD, type II diabetes and metabolic syndrome.

Individuals within the entire cohort who had lower confidence levels at baseline, were less likely to maintain or reduce their waist circumference over the first year of the study; this effect remained for the C group but not the I group, when the treatment groups were analyzed independently. It is noteworthy that, in the I group, WC at 12 months correlated positively with the response to importance of change queried at baseline. It did not correlate however, with other baseline variables of perception. The positive relationship between clinical measures and perceived importance may indicate that individuals in the I group with a larger WC entered the study with a greater sense of need for change than others, even though at baseline, the WC of the groups was not found to be different. Waist circumference increased significantly in the C group at 12 months, but not in the I group.

The greatest difference, and probably the most relevant, related to health perceptions between groups was seen at 12 months. In the I group at 12 months, WC did not correlate with the variables of perception (importance, readiness to change, or confidence). This differs from findings of the C group in that WC at 12 months was associated negatively with “importance” and “readiness to change”; in addition, there was a negative trend with “confidence”.

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Our findings are similar to those of Hankonen et al., who compared the effect of personality with health-related self-efficacy on the change in WC over 12 months. They found self-efficacy to be positively related to WC reduction following group lifestyle intervention. They also noted that baseline self-efficacy had no effect on waist circumference change at 12 months (14). What this suggests is that the level of self-efficacy before a start to make lifestyle changes may not predict those who will be successful in their attempt; and reinforces the notion that self-efficacy is modifiable and a practical target for intervention programs.

The results of the relationship of “importance” to WC in the I group between baseline and 12 months were somewhat inconsistent. These findings may support the assertion that behavior change had occurred during the year in the I group; therefore reducing the importance of making further change.

Confidence in the ability to make changes had a positive association with the number of lifestyle changes made during the 24 months by the present study in the entire cohort, and was independent of treatment group. This would seem to be the case regardless of the mode of information received by the participants. These findings suggest that individuals of both treatment groups, who had showed greater confidence in their ability to make lifestyle changes, at 24 months, also reported making more lifestyle changes. We did not find an association between the perception of importance of change, or the readiness to change with the number of lifestyle changes made.
Commitment, measured in the present study by the number of lifestyle changes participants were willing to make, did increase significantly in the I group by 24 months, but not in the C group. Additionally, the I group reported making more lifestyle changes than the C group; and more of the I than C group participants claimed to have an improved lifestyle as a result of study participation. These results are somewhat consistent with those of a cross-sectional study done by Kelly to determine the predictive ability of behavioral variables on changes in diet. In that study, neither confidence nor importance was a significant predictor of change. However in that study, commitment to change was found to be the most influential and the most predictive variable of stage of change. Commitment values increased with each progressive stage of change, being strongest in the Action and Maintenance stages (8). We could assert that the evidence of increased commitment along with increased number of lifestyle changes made in the present study indicate a transition to an action stage in our intervention group.

Taken together with the findings of the Kelly study, this suggests that the I group transitioned through the stages of change resulting in behavior changes that were not observed or reported in the C group. Further evidence in support of that interpretation was found in our study at 12 months, when the I group identified more barriers to making lifestyle changes than at baseline, and when compared to the C group at 12 months. Contento maintains that both self-efficacy and decisional balance (importance) may change over a course of action as the new behavior may turn out to be more difficult than originally perceived.
It stands to reason that individuals who made efforts towards meaningful change would encounter some unforeseen barriers to adopting a new behavior, and therefore, improve self-efficacy as the change becomes habit, a process that was not expected for the C group. The periodic education over 24 months may have provided the I participants with more lifestyle success "tools" over time, allowing for repeated mastery of the new behavior, and thus, increased self-efficacy.

**Videoconference as an effective health promotion tool**

The use of technology facilitated the WHP intervention of this study in a statewide decentralized worksite, although technology use for such programs is not novel. Distance education for workers delivered online or by videoconference, has been found to be efficacious and economical (1, 16) and educators have found interactive distance learning to be as effective a learning environment as traditional face-to-face methods (17).

In the present study, the simultaneous delivery of educational information and interactive component of the intervention was made possible by the use of an existing videoconferencing network. Ricketts and colleagues used a similar network to compare the efficacy of nutrition education via a videoconferencing network with the same curricula also delivered in traditional face-to-face instruction to health educators. The technology-based distance format was found to be equivalent to the traditional method in attendee satisfaction and learning (18). Employee acceptance of the presently investigated WHP was high. The participants in both treatment groups expressed strongly positive sentiments on
the value of a WHP, emphasizing positive impacts on health and work environment.

We did not test for learning outcomes in this study and cannot comment on the degree of learning differences, if any, between the treatment groups. However, both changes in the clinical variables and reported lifestyle modifications suggested that increasing awareness of a connection between lifestyle behaviors and health and wellness translated into perceptual and behavioral differences between groups, resulting in measurable clinical differences.

Since the face-to-face (albeit distant) education sessions on changes in lifestyle were the primary intervention between the treatment groups, it could be argued that videoconferencing is an effective means of facilitating health promotion that is associated with improvement in health risk factors, mediated by positive lifestyle changes and perceptions of health.

**UNH Cooperative Extension WHP as an internal and external model**

The usefulness of the present study of Cooperative Extension employees goes beyond the positive effects on health that occurred among participants. As an outreach organization, Extension has the opportunity to partner with employers in the community to provide or support efforts to engage in a WHP. A study of an external WHP facilitated by Extension personnel found that participants reduced body weight, WC, increased exercise, and improved their readiness to increase exercise and eat more fruits and vegetables (2).
Furthermore, Extension has provided valuable insight and experience in guiding the development of a WHP at the University of Vermont, based on their own employee wellness program (19).

A recent recommendation for Extension programs related to providing assistance for worksite wellness initiatives is “Practice what you preach”. Extension will increase its credibility as a community partner if there are similar internal efforts to support their own employees through policies or education (2).

**Strengths and limitations**

One of the strengths of this study was the 12 month initial intervention phase, followed by a less intense maintenance period of 12 months. Many studies of WHPs or of health behavior models examine changes that occur over a shorter period of time. We are able to assert that our findings occurred over time and were sustained for a longer term. However, there was attrition in our relatively small participant population, resulting in decreased statistical sensitivity throughout the 24 month period.

A limitation of our study was the fact that many of our results are taken from self-reported data and may suffer from bias or respondent burden over time. It is possible that our lower response rates, in particular at 12 months, resulted in a loss of statistical power to measure statistically significant changes. Another limitation was related to the instruments used to collect descriptive and perceptual data as these were designed to be used for clinical rather than research purposes. Future studies that include measures of psychosocial
influence on behavior change should consider using existing validated instruments designed for that purpose. However, the primary outcomes of this study were the measured clinical data that were collected by the researcher, and the secondary outcomes collected by survey or questionnaire were used to support those clinical outcomes.

**Conclusions**

Findings of the present study demonstrate that a lifestyle education component of a worksite health promotion delivered by videoconference (intervention) can be more effective than education by newsletter alone (comparison treatment). Employees who received education by videoconference improved clinical measures in their total cholesterol, LDL-cholesterol, waist circumference, markers of metabolic syndrome and they reported both increased physical activity and improved diets. The perception of improved lifestyle, even in the presence of barriers, was present in the intervention employees. On the other hand, perceptions of importance of lifestyle change, readiness to change, and confidence in the ability to change, were negatively associated with the health risk factor of waist circumference in the comparison group only. The WHP intervention likely resulted in increased knowledge and heightened health awareness that translated into behavior change and resulted in improved health in the intervention group.
REFERENCES

Chapter 1


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100. Seale JL. Predicting total energy expenditure from self-reported dietary records and physical characteristics in adult and elderly men and women. Am J Clin Nutr 2002;76:529-34.

101. Reddel HK, Toelle BG, Marks GB, Ware SI, Jenkins CR, Woolcock AJ. Analysis of adherence to peak flow monitoring when recording of data is electronic. BMJ 2002;324:146-7.


Chapter 2


Chapter 3


A. IRB Approval

University of New Hampshire
Research Conduct and Compliance Services, Office of Sponsored Research
Service Building, 51 College Road, Durham, NH 03824-3585
Fax: 603-862-3564

7/31/2006

Tagliaferro, Anthony R
Animal & Nutritional Sciences
Human Nutrition Lab
Durham, NH 03824

IRB #: 3744
Study: Test Model of a Healthy Lifestyle Intervention Program
Approval Date: 7/25/2006

The Institutional Review Board for the Protection of Human Subjects in Research (IRB) has
reviewed and approved the protocol for your study as Expedited as described in Title 45,

Approval is granted to conduct your study as described in your protocol for one
year from the approval date above. At the end of the approval period, you will be
asked to submit a report with regard to the involvement of human subjects in this study. If
your study is still active, you may request an extension of IRB approval.

Researchers who conduct studies involving human subjects have responsibilities as outlined
in the attached document, Responsibilities of Directors of Research Studies Involving
Human Subjects. (This document is also available at
http://www.unh.edu/osr/compliance/irb.html) Please read this document carefully before
commencing your work involving human subjects.

If you have questions or concerns about your study or this approval, please feel free to
contact me at 603-862-2003 or Julie.simpson@unh.edu. Please refer to the IRB # above in
all correspondence related to this study. The IRB wishes you success with your research.

For the IRB,

Julie F. Simpson
Manager

cc: File
    Jorie Allen
B. Informed Consent Form

Cooperative Extension Informed Consent Information

Purpose

The purpose of this research project is to gather data from a workplace wellness program at Cooperative Extension.

Description of General Health Screening

Health Questionnaire and Dietary Intake – A three day dietary record will be analyzed for nutrient intake and balance of nutrients in diet and a health questionnaire filled out. Metabolic Screening – A small blood sample (finger stick) will be taken to measure blood levels of fasting sugar, fats, and cholesterol along with blood pressure and waist circumference. Pulmonary Function Test – Forced expiratory air flow in one second and Peak Expiratory Flow will be measured using handheld flow meters. Body Composition – Analysis of total body fat weight and fat free weight (muscle and bone) will be done by bioelectric impedance, a three minute test using painless electrodes on the hand and foot similar to those of an EKG. All tests will be done twice, at the start and after twelve months, except for metabolic screening, and pulmonary function which will be measured at the start, 6 and 12 months later. Some employees will receive printed educational materials only and some employees will also participate in an education program and their physical activity monitored weekly using pedometers. Employees in this group will interact with the program leader and attend monthly lunchtime meetings. The groups will be compared to determine effectiveness.

Benefits and Risks

The general health screening has the potential to help each employee identify strengths and weakness in lifestyles and dietary habits that can be modified regardless of the group assignment. Participants will be given results from cholesterol, triglyceride, glucose, blood pressure, body composition and pulmonary tests. Although these results are not diagnostic, they could be brought to a physician for further evaluation if a participant so wished. Testing and information provided will be free to participants. Peak flow meters will be free to participants. There are few risk associated with the finger stick procedure. Very rarely, dizziness or light-headedness occurs, which can quickly be attended to by trained staff.

Confidentiality

Every effort will be made to ensure confidentiality. Test results will be coded and not directly associated with your name and will be used for data management only.
Consent Form for Participants in Cooperative Extension

Workplace Wellness Program

I, ____________________________ (print name) have been informed and understand that the information provided in the health questionnaire, three-day dietary record and test results of body composition, measurements of blood pressure, glucose, cholesterol, triglycerides and pulmonary function will be used for research purposes.

I have been informed and understand that my participation in the research is voluntary. I have been informed and understand that in reporting any information obtained in this program for research purposes, the protection of my identity will be maintained.

I have been informed and understand that the values obtained by the above tests are not diagnostic. If a question arises regarding these results, I understand that I may take them to my health care practitioner for further evaluation.

I have been informed and understand that if I have any questions or concerns about the use of my personal information, I should contact: Anthony R. Tagliaferro, Director- Center for Health Enhancement, Dept.of Animal and Nutritional Sciences, 518 Kendall Hall, 603- 862-1726. or anthonyt@cisunix.unh.edu.

I have been informed and understand that if I have any questions about my rights as a research subject, I can contact Ms. Julie Simpson in the UNH Office of Sponsored Research at 603-862-2003, or Julie.simpson@unh.edu to discuss them.

I agree to participate ____________________________ name/date.

Print Name ____________________________
C. Additional Clinical Results Not Shown
### C.1 Year 1 MyPyramid Analysis

<table>
<thead>
<tr>
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<th>Comparison</th>
<th>Intervention</th>
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<td>12 Months (n = 13)</td>
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<td>Grains (servings)</td>
<td>9.1 ± 2.6</td>
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<tr>
<td>Vegetables (servings)</td>
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<td>1.7 ± 0.3</td>
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<tr>
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<td>1.2 ± 0.2</td>
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<tr>
<td>Milk (servings)</td>
<td>1.8 ± 0.3</td>
<td>1.8 ± 0.3</td>
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<td>Discretionary calories (Kcalories)</td>
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<td>420.4 ± 87.3</td>
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<tr>
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<td>88.1 ± 12.8</td>
<td>96.6 ± 12.8</td>
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<td>58.5 ± 9.9</td>
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<td>Meat and Beans (% of recommended)</td>
<td>114.5 ± 21.0</td>
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<td>Discretionary calories (% of recommended)</td>
<td>176.0 ± 26.2</td>
<td>168.3 ±26.4</td>
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</table>

* p ≤ 0.05 within group.

Analysis of a subset of diet records returned by the same participants that completed records at both baseline and 12 months. Food-group analysis was based on the portion sizes and categories of the former U.S. Department of Agriculture Center for Nutrition Policy & Promotion MyPyramid (www.MyPyramid.gov).

Analysis was performed using Diet Analysis Plus 8.0 using 3-day self-reported diet record. All variables corrected for age and sex. Statistical analyses were performed by general linear model using SYSTAT 12. Post hoc analysis was performed using Tukey's Honestly-Significant-Difference Test. Statistical significance was set at p ≤ .05.
D. 2 Pulmonary Measures Using Peak Flow Meters

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<tr>
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<td>12 months</td>
</tr>
<tr>
<td></td>
<td>n=21</td>
<td>n=4</td>
</tr>
<tr>
<td>PEF % Pred</td>
<td>78.8 ± 1.1</td>
<td>81.0 ± 2.1</td>
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<tr>
<td>PEF avΔ per day (L/min)</td>
<td>36.5 ± 6.3</td>
<td>21.7 ± 9.9</td>
</tr>
<tr>
<td>FEV1 % Pred</td>
<td>96.0 ± 1.8</td>
<td>96.3 ± 3.4</td>
</tr>
<tr>
<td>FEV1 avΔ per day (L)</td>
<td>0.3 ± 0.1</td>
<td>0.3 ± 0.1</td>
</tr>
</tbody>
</table>

p ≤ 0.05 between groups. Data are presented as LSM ± SE. Statistical analysis performed by General Linear Model using SYSTAT 12. Post hoc analysis was performed using Tukey's Honestly-Significant-Difference Test. Statistical significance was set at p ≤ 0.05.

FEV1 - forced expiratory volume (L) in 1 second, PEF - peak expiratory flow rate (L/min)

% PRED FEV1, % PRED PEF - Test values were compared to predicted normal values for PEF (Nunn AJ, Gregg I. BMJ 1989;298:1068-70.) and FEV1 (Crapo RO, Morris AH, Gardner RM. Am Rev Respir Dis 1981;123:659-64.).

Percent of predicted = (measured PEF or FEV1) / (predicted PEF or FEV1) * 100

PEF avΔ per day and FEV1 avΔ per day = absolute difference between morning and evening measures of PEF and FEV1.

C. 3 Average Reported Steps per Day by Quarter Year

Year 1 and Year 2 in Intervention Group

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<th>p</th>
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</tr>
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<td>Baseline</td>
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<td>6465 ± 368</td>
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<td>17</td>
<td>2</td>
<td>7149 ± 400</td>
<td>0.01</td>
</tr>
<tr>
<td>14</td>
<td>3</td>
<td>6890 ± 440</td>
<td>0.04</td>
</tr>
<tr>
<td>13</td>
<td>4</td>
<td>6878 ± 456</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Year 2</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Baseline</td>
<td>7010 ± 367</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>5</td>
<td>6426 ± 367</td>
<td>0.79</td>
</tr>
<tr>
<td>9</td>
<td>6</td>
<td>6787 ± 458</td>
<td>1.00</td>
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<tr>
<td>7</td>
<td>7</td>
<td>6168 ± 518</td>
<td>0.68</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>6251 ± 705</td>
<td>0.88</td>
</tr>
</tbody>
</table>

Data are presented as LSM ± SE. Statistical analysis performed by General Linear Model using SYSTAT 12. Post hoc analysis was performed using Tukey's Honestly-Significant-Difference Test. Statistical significance was set at p ≤ 0.05; p values represent differences from annual baselines.
E. Survey Instruments with Additional Results
A. Descriptive questions

1. Medical History

<table>
<thead>
<tr>
<th>Condition</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High blood pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type 2 diabetes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metabolic syndrome</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Medications (include oral contraceptives):

   List:

3. Do you take any vitamin, mineral, herbal or other dietary supplements (for example protein powders)?

   ☐ No

   ☑ Yes List:
B. Quantitative questions

4. During the past year, how many days did illness or poor health keep you from work?
   ______ Number of days
   ______ None
   ______ Don’t know
   ______ I prefer to give no answer.

5. How long has it been since you last visited a health care practitioner for a check up?
   ______ Within the past year
   ______ Within the past five years
   ______ Don’t know
   ______ Never
   ______ I prefer to give no answer.

6. What are your approximate annual out-of-pocket medical costs?
   ______ None
   ______ $0 - $500
   ______ $500 - $1000
   ______ More than $1000
   ______ Don’t know
   ______ I prefer to give no answer.

7. Do you smoke cigarettes?
   Yes – How many in a typical day? ____________________
   No
8. Put an X on the line below to show, on a scale from 0 to 10, how important it is for you to make lifestyle changes? (Lifestyle changes are changes to improve your health, such as adjusting your diet, increasing your physical activity, and changing health-related behaviors.)

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>5</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not very important</td>
<td>Somewhat important</td>
<td>Very important</td>
<td></td>
</tr>
</tbody>
</table>

9. Put an X on the line to show how ready you are right now, on a scale of 0 to 10, to make lifestyle changes.

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>5</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not very ready</td>
<td>Somewhat ready</td>
<td>Very ready</td>
<td></td>
</tr>
</tbody>
</table>

10. Put an X on the line to show how confident you are, on a scale of 0 to 10, that you can make lifestyle changes?

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>5</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not very confident</td>
<td>Somewhat confident</td>
<td>Very confident</td>
<td></td>
</tr>
</tbody>
</table>

11. Put an X on the line to show your current level of stress, on a scale of 1 to 5.

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>5</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very relaxed</td>
<td>Managing OK</td>
<td>Very stressed</td>
<td></td>
</tr>
</tbody>
</table>
C. Qualitative Questions

12. What lifestyle changes would you be willing to make?

13. What things might make it hard for you to make lifestyle changes?

D. Participation Questions (at 24 months only)

14. Has participation in UNH Cooperative Extension Workplace Wellness Study impacted your lifestyle (diet and activity choices, health maintenance and stress management)?

   a. Stayed the same
   b. Improved a little
   c. Improved somewhat
   d. Improved a lot
   e. Worsened a little
   f. Worsened somewhat
   g. Worsened a lot
   h. Choose not to answer

15. Has participation in UNH Cooperative Extension Workplace Wellness Study impacted your health?

   a. Stayed the same
   b. Improved a little
   c. Improved somewhat
   d. Improved a lot
   e. Worsened a little
   f. Worsened somewhat
   g. Worsened a lot
   h. Choose not to answer
16. Has participation in UNH Cooperative Extension Workplace Wellness Study impacted how you feel?

   a. Stayed the same
   b. Improved a little
   c. Improved somewhat
   d. Improved a lot
   e. Worsened a little
   f. Worsened somewhat
   g. Worsened a lot
   h. Choose not to answer
### D. 2 Commitment to Lifestyle Changes and Perceived Barriers to Making Changes

<table>
<thead>
<tr>
<th>Questionnaire Variable</th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Comparison</td>
<td>Intervention</td>
</tr>
<tr>
<td></td>
<td>Baseline</td>
<td>12 Months</td>
</tr>
<tr>
<td></td>
<td>(n = 23)</td>
<td>(n = 18)</td>
</tr>
</tbody>
</table>
| Lifestyle changes willing to make (n)  | 1.8 ± 0.2  | 1.5 ± 0.2   | 2.0 ± 0.2  | 1.7 ± 0.2   | 1.7 ± 0.2  | 1.8 ± 0.2   | 2.0 ± 0.2  | 2.5 ± 0.2*^
|                                        |             |             |             |             |             |             |             |             |
| Barriers to making changes (n)         | 1.5 ± 0.1  | 1.4 ± 0.2   | 1.5 ± 0.1  | 1.8 ± 0.2   | 2.0 ± 0.3  | 1.6 ± 0.3   | 1.9 ± 0.3  | 1.9 ± 0.3   |

Questionnaire variables in year 1 and year 2. General linear model performed using age and gender as covariates and post-hoc analyses were conducted using Tukey’s Honestly Significant Difference test. The level of statistical significance was set at \( p \leq 0.05 \). Data are presented as LSM ± SE.

* \( p \leq 0.05 \) within group, \(^\wedge\) \( p \leq 0.01 \) between groups.
D. 3 Workplace Wellness Exit Survey

1. A. As a result of participating in the UNHCE Workplace Wellness program: What lifestyle changes (for example, healthy diet and activity choices, health maintenance and stress management) have you made? Please be specific.

B. As a result of participating in the UNHCE Workplace Wellness program: What health changes have you made? Please be specific.

2. Should UNHCE have a Workplace Wellness Program? Why or why not?

3. Please comment on the UNHCE Workplace Wellness program (what did you like; what did you dislike; do you have any suggestions for changes?)
D.4 Exit Survey Responses 2 and 3.

2. Should UNHCE have a Workplace Wellness Program? Why/Why not?

- Positive impact on health
- Positive effect on work environment
- Efficient use of time and funds
- Needs more frequent meetings
- Needs parity for all sites
- No

3. Comments

Pearson's Chi square analysis was used to examine category responses between groups. Data are presented as the percent of all responses within each group. The level of statistical significance was set at \( p \leq 0.05 \).

2. Responses to Exit Question "Should UNHCE have a Workplace Wellness Program". All categories are NS
3. Comments were classified as "Favorable" and "Unfavorable".
D.5 Exit Question 2 Responses
Should UNHCE have a Workplace Wellness Program? Why or why not?
Transcribed by J. Allen from Exit responses Fall 2008 of participants in the UNHCE WW study

1. Yes! It would be great to have someone to provide wellness programs at UNHCE. Our schedules are atypical for UNH employees, and having someone dedicated to meeting our needs would help to keep staff healthier and more productive. It is far too easy to push these important topics to the side and let work dominate. Our crazy schedules and unusual hours can easily lead to bad eating and exercise habits.

2. I don't know.

3. Yes-encourage/remind us to make better choices; education about choices is good- I learned things from the newsletters.

4. Nutrition information is very helpful. The tests and measurements are good assessments of your progress or lack of progress in maintaining overall good health. Knowing that a healthcare professional is interested in your progress helps you stay focused on good diet and healthy living.

5. Yes! hopefully a motivator for people to try to stay healthier.

6. Yes, increased productivity and decreased stress.

7. Yes- because there are changes I still need to make, despite my good weight blood profile etc. This keeps up my awareness.

8. Depends- If they can find a way to be supportive of all county offices not just those with teleconferencing sites.

9. Yes, a wellness program would make all staff aware of their individual health and a healthy staff leads to less absence due to health problems that can be avoided or prevented.

10. Yes, with trying to balance work and family I do not have a lot of free time.

11. Yes- modeling for our own staff and others we work with and it's an investment in our employees health that we will recoup in their performance and stress level.

12. Yes, I think this program brought together a group that was focused on a benefit for their health. I was not in this group, however did eat lunch with others...I believe it would be a way of encouraging others to eat well and walk at lunch.

13. Yes, is there if we need it. Accurate info, and good opportunities for participation.

14. yes- good to be updated on blood pressure, cholesterol, glucose (screening).

15. Yes. We have high stress responsibilities along with high time expectations. However, along with that needs to be a supervisor who also encourages healthy practices, not one that gives it lip service then adds on more expectations.
16. yes, focus more on stress management- lack of support from organization.

17. yes- to set the standard for health choices/ lifestyle.

18. Yes! Having a workplace focused on employee wellness can have a significant impact on employee health, job satisfaction, & organizational effectiveness.

19. Yes! Most people need assistance sustaining long term wellness initiatives.

20. Yes! Everyone should have to participate in some way- even if its just as little as walking during a break. It's great to know your employer accepts and encourages healthy steps in your life.

21. Yes! It definitely motivated me to focus on my steps and diet. It was an easy way to monitor my blood work, etc. It helps to have others in the office working on being healthy. We try to serve healthy snacks at meetings, etc. Physical wellness affects attitudes and motivation and people work harder and smarter when they in good health.

22. Yes! I think it has been fun and a morale-booster. Promoting wellness sends a positive message of supporting all employees.

23. Yes- wellness improves staff energy & motivation- better productivity.

24. I think a WWP would be helpful as long as it provided sound, practical information as well as social supports for participants. CE staff spend much of their day at work and I believe the social support system can be a big incentive for change.

25. Yes- would be great to have a program. Helpful for ways to combat day to day stress in the job!

26. It is a good idea. It would serve to keep people on track and aware of what they need to do to stay healthy or become more healthy.

27. Yes. It's easier to make changes to your daily routine when working with a group of people. In return the organization gets a staff who is healthy and happier. I would imagine this would equate to improved productivity and less missed days of work due to illness.

28. Yes! To help us keep reminders of the way we should be taking care of ourselves.

29. Yes, it gets people to walk and to watch what they eat.

30. Yes! It would encourage people-employees to continue to make healthier choices in food and encourage exercise. This would lead to a more positive work environment and less "sick" time.
31. I think all employers should have wellness programs feeling good about yourself can translate into feeling good about your job- healthy employees make less medical costs and less sick days.

32. Maybe it has been excellent in some ways. I have really valued the cholesterol screening and pedometer. The meetings were not frequent enough and not terribly valuable, though admittedly I didn't attend many because they took place during an aerobics class that I teach! The health monitoring was very valuable and would be great for UNHCE.

33. Yes, to keep the attention on what keeps us as healthy mindful-action groups.

34. Yes. It would help keep me more aware of my diet & healthy (or bad) habits. By meeting with others with similar goals it should help me make more progress. It is great to get your dietary habits assessed- 1 x per year would be good (or 2x). Lunchtime walking groups would be good.

35. It would be difficult unless all staff were charged to spend a certain amount of time daily/weekly in wellness related activities. Off campus sites don't have the facilities available.

36. This was a great program. By having the pic- tels and newsletters it really helped to focus on the most important things needed to be addressed for better health. There is information overload and you don't know what way to turn or what you should believe as it is always changing.
D.6 Exit Question 3. Responses

Please comment on the UNHCE Workplace Wellness program. What did you like; what did you dislike; do you have any suggestions for changes?

Transcribed by J. Allen from Exit responses Fall 2008 of participants in the UNHCE W W study

1. I was not in the group that attended the monthly meetings and I would have liked to attend- so I disliked that part. 2. I liked the newsletters. They were interesting and informative. I liked Jorie’s very non-judgmental attitude. 3. I liked the periodic testing. The results were consistent with those done by my doctor which gave me more confidences that my improvement was real.

2. Great project! Good luck with your PHD. It was all valuable - although for me the food recall was not so useful. I would have liked my beginning (entry) weight and body fat to compare 2 years later. I would have liked more information on the “peak flow meter” and what it all means.

3.

4. Hard to say anything since I was part of a control group.

5. Did not like being in the control group. Did enjoy working with Jorie Allen. She was terrific and didn't make me feel bad about not losing weight.

6. Great!

7. Newsletters=excellent I was in control group.

8. Everything went well, convenient locations for testing so made it easy to do.

9. Jorie was very pleasant and informative. Newsletter well written but not sent often enough.

10. Worked well for me.

11. I didn't like the finger prick- I liked the analyses every 6 months to show whether I was balanced/ where I should be or ready to! I liked the newsletter.

12. I didn't receive any newsletters or information- only participated in the testing. Not sure what happened- I think there needs to be more confidentiality- though workplaces make that difficult. Glad to have participated. Would like a copy of the final report.

13. I'd like to see more interactive web-based education- such as online quizzes to go along with a healthy topic and newsletters far in place of the newsletter.

14. I enjoyed being a part of this program. It was great to be able to combine this program with my primary care and share the information across the physicians that I have been working with. I also learned information that benefited my position and my family.
15. I liked trying new food products in the first year. I liked the convenience of the workplace testing and the pic-tel lunchtime meetings. Jorie was great to work with! I can't think of any improvements needed. I hope you get good data. Thanks!

16. Education via video conference worked out well. I appreciate that much of the information went into specific detail. It was good to experience this as a county staff together.

17. Health assessments were great. No personal contact which could have lead to better outcomes-more changes, one time per month not enough and quarterly did not seem to have any effect at all for me.

18. I enjoyed it because I am interested in these topics. I would have liked to see more variety in & possibly research of the delivery methods that were used for the education delivery. I think it could have been more effective if it had engaged learners more actively. Thank you so much for the opportunity! I love having the regular health assessments & diet analysis.

19. I liked the monthly meetings and the information that was given. I didn't like keeping track of our activity.

20. Programs were diverse and informative. Screenings were helpful with immediate feedback on progress with cholesterol, blood sugar levels, etc. Though difficult with CE being so spread out, in-person meetings with our county participants would bring a different dimension to program.

21. I loved the meetings. Jorie did an excellent job on sharing information with the group. I only disliked that some of my co-workers were in the control group so we weren't able to share in the same experiences.

22. Jorie did an excellent job!

23. I liked the Program- Jorie did a great job. I like seeing how many steps I could do and improve my health- by doing steps- walk- at least three times a week.

24. I enjoyed learning about the latest in food nutrition and have tried to incorporate the information into my diet.

25. Regular checkups a good base line. Didn't like air intake to be. Newsletters were great. PicTel not a great way to import info.-also lots of technical problems

26. My suggestions would be to monitor activity (steps) for a defined 3-6week period, PAUSE, then monitor again for a short period 6months later. Perhaps it would defeat the purpose, but I think rewards would be helpful. For example, enter all the names of those who reputed steps in a drawing for fitness stuff, OR the highest steps wins, OR...I just think these would keep people reporting data. Another idea would be to issue some kind of challenge to participants- and reward meeting the challenge. For example eat 6 servings of vegetables daily for a week, enter the homecoming 5k, do 100,000 steps in 2weeks, etc. I really enjoyed being part of this and I learned about myself in the process. Thank you for the opportunity!!
27. Like the extra kick butt! Most staff in different manner...Eats were very good.

28. I did not make most of the lunch meetings, but those I did (or got the presentation for) were very helpful. The blood work was also very informative.

29. It was an interesting experience. I liked having the info available. It was manageable within the current schedule I keep.

30. I liked the whole program. I liked dedicating the 1 hour to the pictel to focus on health. It made you be dedicated to the dates we committed to. I liked the topic focus each session- I would like to see periodic sessions we could participate in on pictel. I liked having my screening done on blood weight, etc. I felt it helped give me a personal health profile. Thank you for a great program Jorie. I am glad I got the chance to participate.
E. Participant Clinical Report, Instructions and Self-reporting Forms
### E.1 NUTRITION AND HEALTH REPORT DISTRIBUTED TO PARTICIPANTS

Name: ______________________________ Date: ________________________________

County______________________________

Cooperative Extension Workplace Wellness

NUTRITION AND HEALTH REPORT

<table>
<thead>
<tr>
<th>MY RESULTS</th>
<th>TARGETS</th>
<th>AREA OF HEALTH RISK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body Mass Index (BMI)</td>
<td>♦ Normal = 19-24.9 ♦ Overweight = 25-29.9 ♦ Obese = &gt;30</td>
<td></td>
</tr>
<tr>
<td>BMI Category:</td>
<td>□ Normal</td>
<td>□ Underweight</td>
</tr>
<tr>
<td>Percentage Body Weight</td>
<td>☐ Male: 12-20% ☐ Female: 20-30% ☐ Obese ☐ Normal</td>
<td></td>
</tr>
<tr>
<td>Body Composition</td>
<td>☐ Normal Body Fat %</td>
<td></td>
</tr>
<tr>
<td>Waist Circumference</td>
<td>♦ Men – less than 40 inches ♦ Women – less than 35 inches</td>
<td></td>
</tr>
<tr>
<td>Blood Pressure</td>
<td>♦ Normal = &lt;120/80</td>
<td></td>
</tr>
<tr>
<td>Targets when elevated:</td>
<td>♦ Less than 140/90 ♦ With diabetes, less than 130/80</td>
<td></td>
</tr>
<tr>
<td>Blood Pressure Category:</td>
<td>Normal = Less than 120/80</td>
<td></td>
</tr>
<tr>
<td>Fasting Blood Glucose</td>
<td>♦ 70-100 mg/dl</td>
<td></td>
</tr>
<tr>
<td>FBG Category</td>
<td>□ Normal</td>
<td></td>
</tr>
<tr>
<td>Total Cholesterol</td>
<td>♦ Desirable = Less than 200</td>
<td></td>
</tr>
<tr>
<td>Total Cholesterol Category:</td>
<td>□ Desirable</td>
<td>□ Borderline High = 200-239 □ High = 240 and higher</td>
</tr>
</tbody>
</table>
### LDL-Cholesterol

- **Optimal** = Less than 100
- **Near optimal** = 100-129
- **With diabetes or coronary heart disease** = less than 100

**LDL-Cholesterol Category:**
- [ ] Optimal

**Men** — Low = less than 40
**Women** — Low = less than 50

---

### HDL-Cholesterol

- **Optimal** = High = 60 and higher

**HDL-Cholesterol Category:**
- [ ] Optimal
- [ ] Above Risk Level

**Targets if low:**
- Men — 40 or higher and Women — 50 or higher

---

### Triglycerides

- **Normal** = Less than 150

**TG Category:**
- [ ] Normal

**Area of Health Risk:**
- [ ] Borderline high = 150-199
- [ ] High = 200-499
- [ ] Very high = 500 and higher

---

### Diet

- [ ] Fruits and vegetables: 5 or more servings a day
- [ ] Whole grain breads and cereals: 6-11 servings a day
- [ ] Low-fat dairy: 2-3 servings a day

**Calories:**

- Protein gm ______ % ______
- Carbs gm ______ % ______

**Low consumption of:**
- [ ] Fruits and vegetables
- [ ] Whole grain breads and cereals
- [ ] Low fat dairy foods
- [ ] Meats and protein foods
<table>
<thead>
<tr>
<th>Physical Activity</th>
<th>□ 30-60 minutes a day of moderate activity most if not all days</th>
<th>Low physical activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metabolic Syndrome</td>
<td>♦ Low risk of metabolic syndrome □ Indication of metabolic syndrome</td>
<td>□ Potential exists based on 3 or more indicators:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increased</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ Waist circumference</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ Blood pressure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ Blood sugar</td>
</tr>
<tr>
<td></td>
<td></td>
<td>□ Triglycerides</td>
</tr>
<tr>
<td></td>
<td>Low</td>
<td>□ HDL</td>
</tr>
<tr>
<td>10-year Framingham Coronary Heart Disease Risk</td>
<td>□ Less than 10% risk</td>
<td>□ 10-20% risk</td>
</tr>
<tr>
<td></td>
<td>□ Greater than 20% risk</td>
<td>□ Greater than 20% risk</td>
</tr>
</tbody>
</table>

Fat gm ______ %  ______ Alcohol gm ______ % ______
Fiber gm ______ Saturated fat ______ % ______
Omega 6:Omega 3 ______ P:S ratio ______

Vitamins and Mineral falling below the RDA:
-----------------------------------------------
-----------------------------------------------
-----------------------------------------------
-----------------------------------------------
-----------------------------------------------

High consumption of:
□ Total fat
□ Saturated fat
□ Cholesterol
□ Sodium
Lipid Profile and Blood Glucose Test Explanations

A Lipid Profile is a detailed measure of the fats in your blood. It consists of measuring your total cholesterol, HDL cholesterol, and triglycerides and calculating your LDL cholesterol. NCEP (National Cholesterol Education Program—a study by a panel of experts) ATP III Guidelines recommend a complete lipid profile as the initial test and testing every 6 weeks until lipid goals are met and every 4–6 months thereafter.

The “bad” cholesterol is called Low Density Lipoprotein (LDL) cholesterol. It contributes to the buildup of fat deposits in your arteries (atherosclerosis), which can cause decreased blood flow and heart attack.

About 65% of the cholesterol in your blood is LDL. An LDL of less than 130 mg/dL is desirable. If you have a personal history of coronary heart disease or diabetes, or if you have multiple risk factors, your LDL should be below 100 mg/dL.

Cholesterol is one of several components that form your lipid profile. Total Cholesterol (TC) is a measure of the total amount of both “good” and “bad” cholesterol in your blood at a given time.

TC is measured in milligrams per deciliter (mg/dL). A TC of less than 200 mg/dL is desirable.

The “good” cholesterol is called High Density Lipoprotein (HDL) cholesterol. It removes excess cholesterol from your arteries and moves it to the liver for further processing or to be eliminated from the body.

The higher your HDL, the better. An HDL of 60 mg/dL or higher is beneficial and considered a negative risk factor. An HDL of 40 mg/dL or lower is considered a risk factor for heart disease. A TC/HDL Ratio is total cholesterol divided by HDL cholesterol. Some healthcare professionals may use this ratio to assess risk for developing heart disease—lower ratios are associated with lower risk.

Glucose (GLU) is a measure of the sugar level in your blood. Fasting glucose levels should be below 100 mg/dL. If you are overweight or have a family history of diabetes, your glucose levels should be checked periodically to see if you have diabetes.

Triglycerides (TRG) are composed of fatty acids and glycerol. Like cholesterol, they circulate in your blood, but are stored in body fat and used when the body needs extra energy. While your triglyceride level can be significantly affected by how recently you’ve eaten, total cholesterol and HDL are only slightly affected. After eating, your triglyceride level increases significantly. If your body processes the fat efficiently, the level of triglycerides will decrease naturally. Your fasting triglyceride level should be below 150 mg/dL.

Your healthcare professional will carefully examine the test results of your lipid profile to fully assess your risk for coronary heart disease.

Source: Cholestech Corporation 2005 www.cholestech.com
## E.2 SOURCES FOR CLINICAL TEST VALUE GUIDELINES

<table>
<thead>
<tr>
<th>Measures</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage Fat Mass</td>
<td>Guidelines from the American Council of Exercise (2)</td>
</tr>
<tr>
<td>Waist Circumference</td>
<td>National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) (3)</td>
</tr>
<tr>
<td>Blood Pressure</td>
<td>National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) (3)</td>
</tr>
<tr>
<td>Total Cholesterol</td>
<td>National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) (3)</td>
</tr>
<tr>
<td>LDL-Cholesterol</td>
<td>National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) (3)</td>
</tr>
<tr>
<td>HDL-Cholesterol</td>
<td>National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) (3)</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) (3)</td>
</tr>
<tr>
<td>Metabolic Syndrome</td>
<td>National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) (3)</td>
</tr>
<tr>
<td>Diet</td>
<td>U.S. Department of Agriculture and U.S. Department of Health and Human Services 2005 Dietary Guidelines for Americans, Dietary Reference Intakes (DRI) and Recommended Dietary Allowances (RDA) (4)</td>
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<tr>
<td>Physical Activity</td>
<td>U.S. Department of Agriculture and U.S. Department of Health and Human Services 2005 Dietary Guidelines for Americans, Dietary Reference Intakes (DRI) and Recommended Dietary Allowances (RDA) (4)</td>
</tr>
</tbody>
</table>

E.3 INSTRUCTIONS FOR DIET RECORD

HOW TO RECORD YOUR DAILY FOOD INTAKE

1. Record everything you eat or drink. Use a new diet intake sheet for each day. Indicate the name of the MEAL or the TIME of the snack, WHERE the food is provided or prepared (cafeteria, at home, vending machine, etc.), the FOOD ITEM, the AMOUNT eaten, and briefly describe how it was prepared (fried, boiled, broiled, etc). If the item was a brand name product, include the name.

2. Try to eat what you normally eat and record everything. This dietary survey will only be useful if you give an accurate account of what you eat.

3. List amounts in common household units that you are familiar with (e.g. teaspoons, cup, pat, ounce, inch, etc.).

4. MILK. Indicate whether milk is whole, lowfat (1% or 2%), or skim. Include flavoring if one is used.

5. VEGETABLES AND FRUITS - one average serving of cooked or canned fruits and vegetables is about a half cup. Fresh whole fruits and vegetables should be listed as small, medium or large. Be sure to indicate if sugar or syrup is added to fruit and list if any margarine, butter, cheese sauce or cream sauce are added to vegetables. When recording salad, list items comprising salad and be sure to include salad dressing used.

6. EGGS - indicate method of preparation (scrambled, fried, poached, etc.) and the number eaten.

7. MEAT - POULTRY - FISH - indicate approximate size (e.g. 2 inch by 2 inch by 1 inch) or weight in ounces of the serving. Be sure to include gravy, sauce or breading added.

8. CHEESE - indicate kind, number of ounces, cubic inches, or slices and whether it is made from whole milk, part skim or is low calorie.

9. CEREAL - specify kind, whether cooked or dry and measured or estimated in terms of cups or ounces.

10. BREAD and ROLLS - specify kind (whole wheat, enriched white, rye, etc.), number and thickness of slices or size in inches. Remember to include in your description any butter or margarine used on bread.

11. BEVERAGES - include every item you drink including water. Be sure to record cream and sugar used in tea and coffee, whether juices are sweetened or unsweetened and whether soft drinks are diet or regular.

12. FATS - remember to record all the butter, margarine, oil and any other fats used in cooking or on food.
13. **VITAMINS and/or MINERAL SUPPLEMENTS** - indicate type and quantity consumed and amount of nutrients provided.

14. **MEDICATIONS** - indicate name and prescribed dosage.
PORTION GUIDE

SEVEN WAYS TO SIZE UP YOUR SERVINGS

Measure food portions so you know exactly how much food you're eating.
When a food scale or measuring cups aren't handy, you can still estimate your portion. Remember:

1. 3 ounces of meat is about the size and thickness of a deck of playing cards or an audiocassette.

2. A medium apple or peach is about the size of a tennis ball.

3. 1 oz of cheese is about the size of 4 stacked dice.

4. ½ cup of ice cream is about the size of a racquetball or tennis ball.

5. 1 cup of mashed potatoes or broccoli is about the size of your fist.

6. 1 teaspoon of butter or peanut butter is about the size of the tip of your thumb.

7. 1 ounce of nuts or small candies equals one handful.

MOST IMPORTANT

Especially if you're cutting calories, remember to keep your diet nutritious:

- 2-4 servings from the Milk Group for calcium
- 3-5 servings from the Vegetable Group for vitamin A
- 2-4 servings from the Fruit Group for vitamin C
- 6-11 servings from the Grain Group for fiber
FOOD RECORD SHEET

**NAME:** _______________________________  **Data:** _______________________________

<table>
<thead>
<tr>
<th>Meal or Time</th>
<th>Where Eatcn</th>
<th>Food Item</th>
<th>Amount</th>
<th>How Prepared</th>
<th>Code</th>
<th>Amount</th>
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</thead>
<tbody>
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</tbody>
</table>
E. 4 PEAK FLOW REPORTING FORM

Essentials for getting quality measurements
- You MUST breathe in as deeply as possible; this is critical for a reproducible measurement.
- Put the mouth piece in your mouth and seal your lips, do not just press the mouthpiece up against your lips.
- Wait for at least 30 seconds between tests
- **Measure your Peak Flow Rate close to the same time each day.** One suggestion is to measure between 7 and 9 a.m. and between 6 and 8 p.m.

A "normal" Peak Flow Rate is based on a person's age, height, sex and race. A standardized "normal" may be obtained from a chart comparing the patient with a population without breathing problems. Therefore, it is important for you and your doctor to discuss what is considered "normal" for you. 2006 American Lung Association®.

Instructions for performing a Peak Flow Rate Test are on the back side of this chart. Please do the test twice daily for a week, following these instructions. When the week is over, please mail the chart in the self-addressed stamped envelope provided. IMPORTANT: Don't throw your peak flow meter away. We will use it for repeat tests.

<table>
<thead>
<tr>
<th>Peak Expiratory Flow Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
</tr>
<tr>
<td>Liters/min am pm am pm am pm am pm am pm am pm am pm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Forced Expiratory Volume in one second (FEV₁)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
</tr>
<tr>
<td>am pm am pm am pm am pm am pm am pm am pm am pm</td>
</tr>
<tr>
<td>Liters</td>
</tr>
</tbody>
</table>
PROCEDURE FOR USING KOKO PRO 6 PEAK FLOW METER.

- hold the meter away from the mouth (making sure the vents are not covered) and breathe in as DEEPLY as possible
- press the blue button on the device, and wait for the second beep
- seal your lips around the mouthpiece
- blast air out as fast and as far as you can, until the lungs are absolutely empty
- in a few seconds the PEF and FEV1 readings will be displayed
- repeat the measurement 3-times and record the highest test value
- only record PEF and FEV1. The lower display will alternate values, be sure it is FEV1 that you record

The Display

**PEF** – Peak Expiratory Flow rate
PEF is the highest rate of flow that you can exhale. It can occur at any time during your exhalation. PEF is a measure of the respiratory system’s ability to clear air from the lungs. PEF depends on your body size, sex, race, gender and age. PEF is measured in liters per minute.

**FEV1** – Forced Expiratory Volume in the first second
FEV1 is the volume of air that you exhaled during the first second. Measured in liters.
These exercise equivalents were developed so participants who enjoy activities in addition to walking can log credit for those different activities. These are estimates. 2000 steps measured with a pedometer = 1 mile.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Steps per minute</th>
<th>Activity</th>
<th>Steps per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobics, high impact</td>
<td>203</td>
<td>Golfing with a cart</td>
<td>101</td>
</tr>
<tr>
<td>Aerobics, low impact</td>
<td>145</td>
<td>Grocery shopping</td>
<td>67</td>
</tr>
<tr>
<td>Aerobics, step</td>
<td>246</td>
<td>Handball</td>
<td>348</td>
</tr>
<tr>
<td>Badminton, casual</td>
<td>131</td>
<td>Hiking, 10 – 20 lb load</td>
<td>217</td>
</tr>
<tr>
<td>Badminton, competitive</td>
<td>203</td>
<td>Hiking, 21 – 42 lb load</td>
<td>232</td>
</tr>
<tr>
<td>Basketball, game</td>
<td>230</td>
<td>Orienteering</td>
<td>260</td>
</tr>
<tr>
<td>Basketball, recreational</td>
<td>174</td>
<td>Painting</td>
<td>131</td>
</tr>
<tr>
<td>Bicycling, leisurely</td>
<td>116</td>
<td>Pilates</td>
<td>101</td>
</tr>
<tr>
<td>Bicycling, stationary</td>
<td>203</td>
<td>Ping Pong</td>
<td>116</td>
</tr>
<tr>
<td>Bowling</td>
<td>87</td>
<td>Racquetball, casual</td>
<td>203</td>
</tr>
<tr>
<td>Boxing</td>
<td>348</td>
<td>Racquetball, competitive</td>
<td>290</td>
</tr>
<tr>
<td>Canoeing, light</td>
<td>87</td>
<td>Raking leaves</td>
<td>125</td>
</tr>
<tr>
<td>Chopping wood, around home</td>
<td>174</td>
<td>Roller skating</td>
<td>203</td>
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<tr>
<td>Circuit training</td>
<td>232</td>
<td>Rowing, light</td>
<td>101</td>
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<tr>
<td>Cross-country skiing, intense</td>
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<td>Rowing, moderate</td>
<td>203</td>
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<tr>
<td>Cross-country skiing, moderate</td>
<td>232</td>
<td>Running, 10 mph (6 min/mile)</td>
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<tr>
<td>Cross-country skiing, slow</td>
<td>203</td>
<td>Running, 8 mph (7.5 min/mile)</td>
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<tr>
<td>Dancing</td>
<td>131</td>
<td>Running, 6 mph (10 min/mile)</td>
<td>290</td>
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<tr>
<td>Downhill skiing</td>
<td>174</td>
<td>Running, 5 mph (12 min/ mile)</td>
<td>232</td>
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<tr>
<td>Elliptical trainer</td>
<td>203</td>
<td>Scuba diving</td>
<td>203</td>
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<tr>
<td>Firewood, carrying</td>
<td>145</td>
<td>Snow shoveling</td>
<td>174</td>
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<tr>
<td>Firewood, sawing with handsaw</td>
<td>217</td>
<td>Snowboarding, light</td>
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<tr>
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<td>Snowboarding, moderate</td>
<td>182</td>
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<tr>
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<td>260</td>
<td>Soccer, recreational</td>
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<tr>
<td>Gardening, light</td>
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<td>Soccer, competitive</td>
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<tr>
<td>Gardening, heavy</td>
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<td>Softball</td>
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<td>Activity</td>
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<tr>
<td>Stair climbing moderate</td>
<td>334</td>
<td>Jumping rope, fast</td>
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<tr>
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<tr>
<td>Stair climbing, vigorous</td>
<td>434</td>
<td>Karate</td>
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<tr>
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<td>Kickboxing</td>
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<td>Swimming, backstroke</td>
<td>203</td>
<td>Mowing</td>
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<tr>
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<td>290</td>
<td>Tae Kwon Do</td>
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<td>319</td>
<td>Tai Chi</td>
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<td>Tennis, doubles</td>
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<tr>
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<td>Tennis, singles</td>
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<td>Trampoline</td>
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<tr>
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<td>172</td>
<td>Volleyball, game</td>
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<td>Wash the car</td>
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<td>Water aerobics</td>
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<td>Water skiing</td>
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<td>Wax the car</td>
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<td>101</td>
<td>Weight lifting, moderate</td>
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<td>Weight lifting, vigorous</td>
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<tr>
<td>Judo</td>
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<td>Yoga</td>
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