

Final Progress Report

Title: SHIELD: Safety & Health Improvement: Enhancing Law Enforcement Departments

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List of Terms and Abbreviations

BMI: Body Mass Index

LEO: Law Enforcement Officers

LEP: Law Enforcement Personnel

SHIELD: Safety & Health Improvement: Enhancing Law Enforcement Departments

STTR: Small Business Technology Transfer

SBIR: Small Business Innovation Research

WC: Worker's compensation

Abstract:

The National Institute of Occupational Safety and Health recognizes that effective worksite health promotion programs may be low-cost solutions to rising medical expenditures, while reducing absenteeism and improving productivity. Occupational wellness programs have the potential to benefit both workers and their employers; however, a recent review found that few in use had documented effectiveness, and only a small number of the evidence-based programs were available for widespread use. Even less programs have evidence for outcome durability. Assessment of dietary habits, physical activity behaviors, and weight loss maintenance is rare more than one year following an intervention, and in general, initial positive changes have not persisted. The SHIELD (Safety & Health Improvement: Enhancing Law Enforcement Departments) study, sponsored by the Centers for Disease Control and Prevention and the National Institute for Occupational Safety and Health, is designed to investigate strategies to promote health and safety of law enforcement personnel (LEP). Our peer-led, team-based format is proven effective with fire fighters and athletic teams; SHIELD extends this format the public safety sector. LEP are tasked with the critical work of protecting the population's safety and they have unique health issues that impact their well-being, longevity, job performance and safety. Overall, the LEP's life expectancy is between 6 and 15 years less than the average American. SHIELD addresses the following modifiable factors that adversely impact LEP's health, safety and work performance, namely: stress, sleep deprivation, eating habits, body weight, smoking, alcohol use, injury prevention and physical activity.

The SHIELD Study tested the efficacy and durability of a team-based worksite health promotion intervention for law enforcement personnel in a randomized prospective trial. The SHIELD program was feasible and effective in promoting the health and safety of law enforcement officers and support personnel. Both intervention and control group were studied for 24 months, longer than the majority of health and safety randomized trials. Significant program effects were observed for of fruit and vegetable consumption sleep, general health, stress, tobacco and alcohol. Qualitative interviews were conducted to further explain the observed differential durability of positive behavioral outcomes. Improvements in eating habits persisted through 24-months of testing while improvements in sleep quantity and quality were significant through six-months. Interview findings reveal that participants retained broad categories of health and safety information from SHIELD sessions. Participants referenced novel information tailored to their work delivered in memorable way. Interviews also revealed that peer modeling, encouragement and norms helped sustain some behaviors more than others. For eating behaviors that reinforcement appeared to sustain the change. To sustain invisible behaviors, such as sleep, specific means, such as environmental cues, self-monitoring and booster content may be needed for maintenance. While many studies among law enforcement workers highlight the adverse health outcomes faced by those in this profession, this study is promising in that it suggests that tailored lifestyle and behavior change interventions could counter the adverse health effects associated with work in law enforcement.

Section 1: Significant Key Findings

The following significant key findings fulfill the three specific aims of SHIELD. These Aims include the following objectives: implementation of a randomized controlled trial of the SHIELD occupational safety and health program, assessment of program effects, mediation of behavioral and occupational variables and cost effectiveness.

Key Finding 1: Fruit and Vegetable Intake, Healthy Eating

Chronic diseases are responsible for 7 of 10 deaths among Americans each year and treatment of those conditions account for more than 75 percent of \$2.5 trillion spent annually.

(www.cdc.gov/workplacehealthpromotion/nhwp/) LEP have increased cardiovascular disease, metabolic syndrome, diabetes, and certain cancer types as compared to U.S. adults, and these may in part be related to poor dietary habits. Diets that increase daily servings of fruits and vegetables lower risk of chronic disease. Significant improvements in healthy eating and fruit and vegetable consumption were observed and durable at 24 months. This durability, coupled with qualitative findings, suggest SHIELD created a healthier eating culture and has broad potential to improve the health of the 1.2 million LEP working in the US.

Key Finding 2: Mood, Stress, Sleep

LEP have a high prevalence of sleep and stress related disorders associated with adverse health outcomes including disability, obesity, metabolic syndrome, reduced presenteeism, and lost work days. SHIELD included strategies focusing on mood, stress and sleep for improving health, safety and productivity. SHIELD significantly lowered stress and improved sleep quality and quantity at 6 months. These positive changes did not persist after the team-based intervention phase of the study concluded.

Key Finding 3: Tobacco and Alcohol

Tobacco use remains the single largest preventable cause of disease and premature death in the US, accounting for more than \$11 billion in health care costs annually (<http://www.cancer.org/research/infographicgallery/tobacco-related-healthcare-costs>). The SHIELD program produced significant reductions in tobacco use which persisted through 24-months. Excessive alcohol consumption reduces workplace productivity, increases health care costs and increases injury and accidents and is responsible for more than 88,000 people in the U.S. each year. (www.cdc.gov/features/alcoholconsumption/). SHIELD produced significant reductions in excessive alcohol consumption at 12-months.

Key Finding 4: Mediation of Behavioral Outcomes

A series of mediation analyses were run at post-test to test three separate mediation models. Results showed that the program's effect on fruit and vegetable consumption was fully mediated by personal monitoring of dietary intake. The outcome of self-reported exercise was significantly related to increased knowledge of the benefits of physical activity as a mediator, but the program did not significantly change the mediator. Stress was also related significantly to the mediator of team cohesion, but the program did not significantly influence team cohesion. These results are significant in determining how SHIELD achieved its effects.

Key Finding 5: Cost analysis

Workers' compensation claim rates were collected and analyzed from 2006-2013 in both study groups. The number of claims and the associated medical costs were significantly lower in the intervention group at the conclusion of the study. SHIELD is feasible and may be a cost effective approach to improving the health and safety of this occupational group.

Translation of Findings

Worksites have the potential to be effective vehicles for health promotion. Interventions can be delivered, social norms altered, peer support recruited, and environments restructured to benefit both workers and their employers. SHIELD was conducted at three large law enforcement departments with LEP participating in program activities at the worksite, during work hours. The SHIELD program is exportable and scalable. Its use at other law enforcement departments would require little modification. In our research of translation of occupational health programs in first responders, we determined that department leadership, scheduling, balancing competing demands, and tailoring were factors related to translation. A mechanism to disseminate SHIELD is an SBIR/STTR grant. Dr. Kuehl has communicated with the SBIR/STTR project officer regarding grant funding for developing a commercialized product for dissemination.

Outcomes/Impact:

Potential outcomes:

The success of the SHIELD program in improving health and safety practices in LEP has tremendous potential to impact emergency services personnel in the public safety sector. SHIELD is a cost effective, worksite health promotion program that improves nutrition and sleep, reduces stress, tobacco and heavy alcohol use with concomitant reductions in worker compensation claims. SHIELD has the potential to reduce rising medical costs, absenteeism and improve productivity among this workforce.

Intermediate outcomes:

The outcomes of the SHIELD project have contributed to local and national scientific agenda and policy. Principal Investigator, Dr. Kerry Kuehl, has helped shape NIOSH's research agenda for the public safety sector and contributed to the CDC's National Occupational Research Agenda. Dr. Kuehl has extended this research from LEP to correctional officers working in local jails and prisons. He continues to consult with law enforcement departments and department of corrections on mitigation strategies and preventive strategies to improve the health and safety of LEP and corrections personnel on a local and national level.

End outcomes:

The SHIELD project resulted in clinically significant health behavior improvements that reduce risk of chronic disease and improve workplace safety and productivity. Documented improvements were observed in eating habits, general health, sleep quantity and quality and reductions in stress, tobacco use and heavy alcohol use. Reductions in work-related injury, illness, and exposure also decreased as evidenced by a significant reduction in worker's compensation claims in the SHIELD intervention group as compared to control.

Section 2: Scientific Report

Background:

In the U.S., more than 1 million individuals work in law enforcement. Charged with the critical work of protecting the population's safety, these individuals have unique health issues that impact their well-being, longevity, and, importantly, their job performance and safety. Certain law enforcement work-related issues are well recognized, such as the importance of physical abilities in apprehending suspects; shift work including long work hours; and the ever present psychological stress of law enforcement work. Additionally, law enforcement personnel are a high-risk group for musculoskeletal injuries, fatigue/stress-related disorders, sleep disorders, metabolic syndrome, and cardiovascular disease. Overall, the life expectancy of those working in law enforcement is between 6 and 15 years less than the average American. Although research has highlighted elevated risk factors and corresponding health outcomes among this population, evidence-based occupational safety and health programs for law enforcement workers are lacking.

Shift work, psychological stress and physical demands affect the work performance and safety of law enforcement officers. Policing has one of the highest non-fatal injury and illness rates in all worker populations with 11.3 injury cases per 100 full-time workers in 2011. In addition, 40 percent of all days-away-from-work cases among local government workers occurred to police officers (Bureau of U.S. Labor Statistics 2013). Modifiable factors play a critical role in law enforcement work, health and safety: high stress, sleep deprivation, lack of physical fitness, unhealthy eating, tobacco and alcohol use. Additionally, there is a high prevalence of metabolic syndrome among LEP and this is associated with increased injuries and workers compensation claims. Modifying these factors offer a potential to enhance the work-performance and safety of LEP and to gain major societal economic savings in worker's compensation claims and medical costs.

The SHIELD (Safety & Health Improvement: Enhancing Law Enforcement Departments) study addressed modifiable health and safety factors by utilizing the tight knit workgroups that characterize law enforcement work. LEPs rely on a team effort for safety and effectiveness. This work structure and organizational culture is suited for a team-based health promotion program comprised of colleagues working the same shift or fulfilling similar work roles. The final scientific report on this randomized control trial is presented here.

Specific aims

The specific aims remained unchanged over the project period and all aims were completed in full according to the timeline planned.

Aim 1. Implement a randomized controlled efficacy trial of the SHIELD intervention: a peer-led, team-based occupational wellness program, and assess its behavioral and occupational outcomes.

Four hundred eighty-nine participants from three law enforcement organizations (Vancouver Police Department, Marion County Sheriff's Office and Clark County Sheriff's Office) were enrolled in SHIELD. Participants completed physical and written testing at baseline, 12-months and 24-months, and written-only testing at 6-months. Physical testing

included: treadmill exercise stress test (baseline only), blood biomarkers, strength and flexibility, vigilance testing, and height, weight, blood pressure, waist, hip, and neck measurements. All participants were tested at their place of employment by SHIELD research staff. Participants were grouped in work-based teams and randomly assigned to either the testing only group or testing plus team wellness program curriculum group. A total of 95 teams (4-7 subjects per team) were formed and 48 teams implemented and completed the team-based health promotion intervention curriculum.

The curriculum was written by SHIELD research staff and tailored to law enforcement personnel (LEPs) based on pilot study observations and focus groups. The curriculum was comprised of 12, 30-minute sessions and completed during work hours. Thirty-seven percent of curriculum sessions were observed by research staff to measure fidelity and participant attendance. Ninety-five percent of all sessions were completed by June 2012; 97% of curriculum content was delivered and attendance averaged 86%. Data from the pilot study and at 6-months show significant improvements in CVD risk factors, sleep duration, and intake of fruits and vegetables among the intervention participants. Data from 12 and 24-month testing showed a sustained improvement in fruit and vegetable consumption, healthy eating, and a reduction in tobacco and heavy alcohol use. These findings are significant steps to improve the health of law enforcement personnel and ease the financial strain of law enforcement departments. The results are presented in more detail below.

Aim 2. Determine relations among variables in the chain from exposure of LEP subjects to specific intervention components to changes in mediating variables to behavior changes and occupational outcomes.

Dr. David MacKinnon's statistical lab at Arizona State University analyzed all waves of data for this project. Baseline data underscore the need for a health intervention: Only 17% of LEP were at optimal body weight with 38.5% obese (BMI > 30) and 43.8% overweight (BMI > 25.1 <29.9). Thirty-four percent of LEP met criteria for metabolic syndrome. Nearly 50% of LEP averaged < 6 hours of sleep per 24 hours and fruit and vegetable intake was 3.4 servings per day; 16.5% of the LEP were current smokers.

Program effects were analyzed in a series of multilevel models, including individuals nested within teams. Program effects, adjusted means and p-values for the test of baseline versus the average of the 6, 12, and 24 month follow-ups for the outcome variables showed significant program effects were present for fruit and vegetable consumption, healthy eating, sleep quality and quantity, general health, stress, tobacco and heavy alcohol use.

Mediation analysis was conducted at post-test to evaluate three separate mediation models. Results showed that the program's effect on fruit and vegetable consumption was fully mediated by personal monitoring of dietary intake. The outcome of self-reported exercise was significantly related to increased knowledge of the benefits. Stress was also related significantly to the mediator of team cohesion.

Aim 3. Perform a cost analysis to determine the economic benefit of this LEP worksite health promotion program.

Workers' compensation claim rates were collected and analyzed from 2006-2013 in both study groups. This date range provided claims data before baseline testing and study implementation and after the intervention was completed. Claims data included the following variables: nature of injury, body part description, cause of injury, work days lost and sum total dollars incurred. Analysis of this data revealed that the number of claims and the associated medical costs were significantly lower in the intervention group at the conclusion of the study. This finding will aid in SHIELD's dissemination to other law enforcement agencies.

Methodology

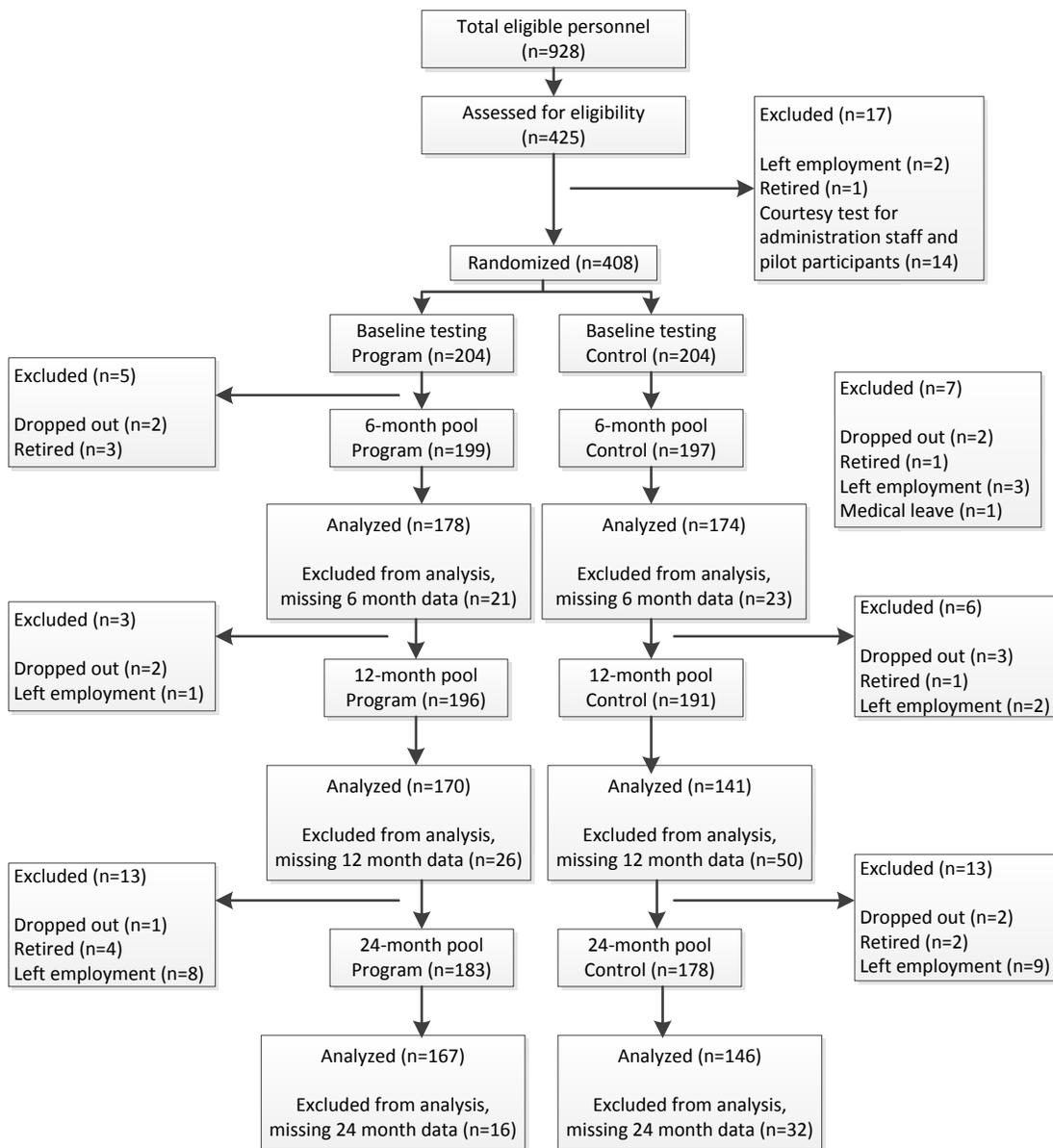
Study population and recruitment

Partnering law enforcement organizations included one police department employing approximately 200 sworn and 35 civilian staff, a sheriff's office employing approximately 246 sworn officers and 106 civilian staff, and a sheriff's office with 244 sworn officers and 97 non-sworn personnel. The two sheriff's offices were recruited due to similar size, staffing patterns, and scheduling. The police department was recruited due to its natural division of staff into two precincts. A total of 408 individuals from across the participating organizations consented to participate in the study. The Institutional Review Board of the Oregon Health & Science University approved the study in April of 2010.

Randomization

The intervention was delivered to teams of participants. Prior to randomization, all study participants were organized into teams, consisting of three to seven persons who work together at the same or similar jobs. Most teams were naturally occurring (e.g., patrol officers on the same shift), and some were assigned based on similar job description and work location (e.g., support staff at a single location). Teams were then assembled into blocks based on shift, schedule, and physical work location. Each block consisted of one to six teams. The blocks were organized into matched pairs: patrol blocks were matched with patrol blocks, jail staff blocks matched with jail staff blocks, training unit blocks matched with training unit blocks, and remaining blocks matched in a similar manner. The formation of blocks reduced that the risk of diffusion of intervention content among teams. Blocks only were used for matching in randomization, and had no bearing on program delivery. This scheme organized the 86 teams into 21 matched pairs of blocks. After the blocks were randomized, 204 participants from 45 teams in 21 blocks were assigned to the treatment condition and 204 participants from 41 teams in 21 blocks became controls. For the three departments, of the 928 eligible employees, 408 were randomized and enrolled. Eighty-one participants were tested but not randomized because they participated in the pilot intervention or joined the project in later waves of testing. Because we tested participants at they worksite, we did not exclude participants from joining at later waves. The enrollment table total of 489 includes all participants consented and tested even if they were not randomized and differs from the numbers randomized in figure 1.

Figure 1



Measures

Study participants completed written surveys at baseline, 6, 12 and 24 months. The survey instrument included information about demographics, position, years of service, and work schedule. Items were assessed using constructs with established reliability from our previous studies supplemented by items/constructs from published instruments. Survey components included: diet, physical activity, sleep, fatigue, pain, stress, tobacco, alcohol and depression. More information on the scales can be obtained at the RIPL website <http://www.public.asu.edu/~davidpm/ripl/Phlame.htm>.

Physical testing was conducted at baseline, 12 and 24 months. Physical tests included measurement of blood lipids, fasting blood glucose, blood pressure, body weight, height and body composition. The physiological assessment includes height, weight (Tanita scale [Model: 310GS]) and blood pressure (OMRON [Model: HEM-907XL]). Laboratory values were assessed

with finger sticks and capillary tube analyses for fasting blood glucose, total cholesterol, and triglyceride concentrations (Cholestech PA Analyser).

Worker's Compensation Data

We retrospectively collected worker's compensation (WC) claims and medical costs among law enforcement departments over an 8 year period (2006-2013). Claims data included the following variables: nature of injury, body part description, cause of injury, work days lost and sum total dollars incurred. Primary outcomes were total annual WC claims, annual WC claims per LEP and total annual medical costs (in US dollars). All study sites tracked monthly work-related WC claims and medical costs. The total number of claims and medical costs of the intervention group and the control group were derived from these monthly reports. We divided the data on 5-year baseline period (2006-2010) and 2-year post-intervention period (2012-2013) to study the effect of health promotion program on the work-related injuries and their medical costs. The data were averaged in the baseline and post-intervention period to report the total annual number of claims and medical costs per a participant for each study group. All claims were de-identified to protect participant confidentiality. Total incurred medical costs were calculated from the perspective of the payer.

Qualitative Data

Group interviews were a convenience sample of intervention participants; each team was interviewed individually approximately 24-months after the intervention. Eleven 60-minute team interviews were held with a total of 38 law enforcement employees. Inter-viewers used a semi-structured guide, which outlined a series of open-ended questions in the domains of what they remembered most about the team session, along with potential promoters and hindrances to long-lasting health behaviour change relating to diet, exercise and sleep habits. Probative follow-up questions were included to expand on responses. The roadmap strategy allowed comparison of responses across groups. Because of the group setting, individual actions concerning alcohol use were not explored. Interviews were audiotaped, transcribed, reviewed for accuracy, redacted of names, and assembled for analysis.

Intervention

Participants randomized to the intervention, participated in twelve, 30-minute, team-based, scripted, peer-led sessions during the first six study months. No additional intervention team meetings were after that time. Sessions were scheduled weekly during work hours, and each included three to four brief activities. The team format encouraged accountability as well as fostering social support at the worksite. Participants checked-in each session about weekly goals, and scripted discussion prompts elicited shared strategies for improving health behaviors. The lifestyle factors addressed in the SHIELD program included: healthy diet, daily physical activity, achieve and maintain optimal body weight, reduce stress, increase sleep, decrease tobacco and heavy alcohol use. Other than six hours of session participation, no changes to the work environment, food service or work schedule were made.

Control

Individuals assigned to the control condition participated in the same written and physical testing as the intervention group. Testing results were communicated with appropriate medical advice and follow up for abnormal test results with their physician. No other health promotion educational materials were provided to control participants.

Statistical Analysis

The statistical analyses were designed to reflect nesting of individual persons within the 86 teams. The SAS Mixed program was used to estimate this multilevel regression model. Missing data at the follow-up measurements were treated as missing at random by including baseline measures in the statistical analyses. In the repeated measures model, significant group by time interactions represented program effects, consistent with differential change over time in the program versus control conditions. The group by time interaction incorporated change between groups across all four time points. A primary contrast in this analysis was a test of whether the change between baseline and the average of the follow-ups differed between treatment and control groups. Additional contrasts compared group differences in change from baseline to each follow-up time.

Qualitative Analysis

Thematic content analysis involved reiterative readings of interview transcripts to identify and code patterns and influences on the impact of the wellness program based on participants' actual experiences. Construction of themes and interpretations avoided the substantive bias inherent in a priori categorization, instead adapting the more inductive constant-comparative method typical of grounded theory. As the data set was subjected to micro-review in a search for data that might confirm or refute tentative interpretations, emergent themes evolved. Preliminary findings were constructed, and to surface and evaluate rival explanations, theoretical triangulation was undertaken involving expectancy. Organized thematically, the presentation of results emphasizes participants' actual phrasing. The "vicarious experiences" provided by the interview excerpts are intended to enhance understanding and the development of "tacit knowledge," more influential than "propositional knowledge" for generalization to other occupational settings.

Results

Adherence to Format and Acceptability

The curriculum was delivered with high fidelity. For the 37.6% of the sessions observed, the average length was 31.4±11 minutes (mean ± SD), and 97% of the scripted content was delivered. During sessions that were observed, the average attendance was 87% of team members.

Program Effects

Program effects were analyzed in a series of multilevel models, including individuals nested within teams. Table 1 lists the estimates of program effects, adjusted means and p-values for

the test of baseline versus the average of the 6, 12, and 24 month follow-ups for the outcome variables. The column under post-test mean shows whether significant program effects were observed in the comparison of baseline to the average of the three follow-up measures thereby providing an overall test of the program across time points. Significant program effects were present for fruit and vegetable consumption, healthy eating, sleep quality and quantity, general health, stress, tobacco and heavy alcohol use.

Table 1

| Baseline VS. Average of 6, 12, and 24 Month Follow-ups | | |
|---|-----------------|----------------|
| Variables | Estimate | P-value |
| Fruit consumption* | 2.631 | <.0001 |
| Vegetable consumption* | 2.312 | 0.0079 |
| Fruit/Vegetable consumption* | 4.949 | <.0001 |
| Fat consumption | 0.089 | 0.2852 |
| Sleep Quality* | 0.530 | 0.0076 |
| Sleep Quantity± | 0.324 | 0.0812 |
| Karolinksa Sleepiness scale | 0.098 | 0.8468 |
| Fatigue | 0.154 | 0.3118 |
| SF36: General Health± | 0.218 | 0.0988 |
| Musculoskeletal Pain | -0.021 | 0.6179 |
| Musculoskeletal Pain with Foot Pain | -0.021 | 0.6179 |
| Stress Self* | 0.501 | 0.0432 |
| Healthy Eating Self* | 0.405 | 0.0045 |
| Physical Activity Self | -0.057 | 0.7657 |
| Burnout | 0.065 | 0.8166 |
| Tobacco Use* | 0.119 | 0.0330 |
| Alcohol Consumption± | 0.084 | 0.0604 |
| Depression | 0.234 | 0.3294 |

* Indicates statistically significant program effect of group by time. $p < 0.05$.

± Indicates marginally significant program effect of group by time. $p < 0.10$.

^A Indicates statistically significant effect of covariate Age on scale variable.

^G Indicates statistically significant effect of covariate Gender on scale variable.

Fruit and vegetable consumption were significantly improved for the intervention group at all follow-up time points (Figure 2). The effect size for fruit and or vegetable consumption ranges from 0.29 to 0.49, with fruit consumption consistently showing greater effect sizes. The construct measuring healthy eating also showed significant program effects at each follow up point, with effect sizes ranging from 0.16 to 0.34.

Figure 2

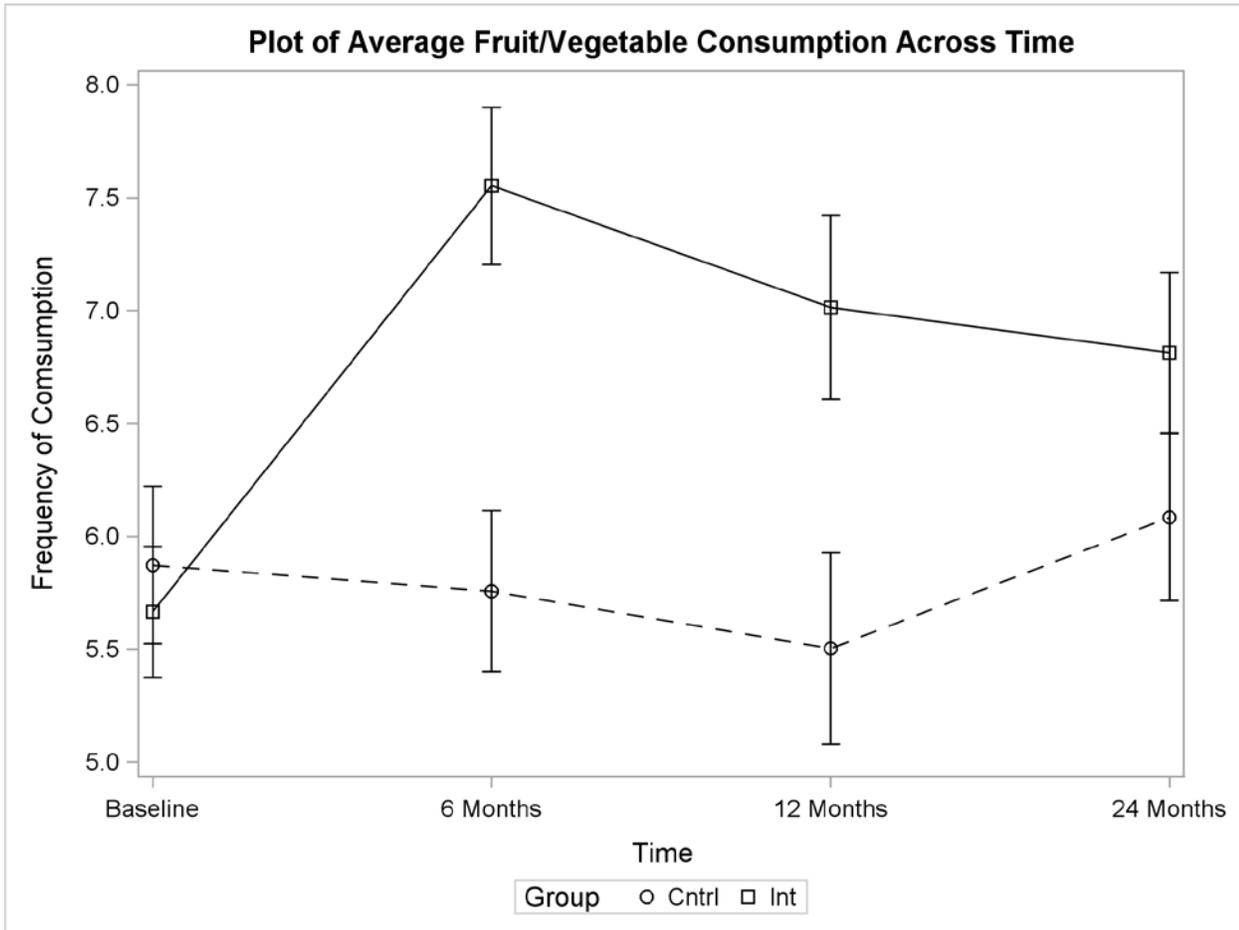


Figure 2. Average fruit/vegetable consumption for the intervention and control groups at each time of measurement +/- 1 standard error bars. Higher scores indicate higher consumption of fruits and vegetables.

Significant program effects for sleep, stress and general health variables were observed at 6 month follow-up but not at the 12 and 24 month follow-ups. Figure 3 shows the pattern of change for sleep quality, and a similar pattern was seen for sleep quantity and amount of sleep.

Figure 3

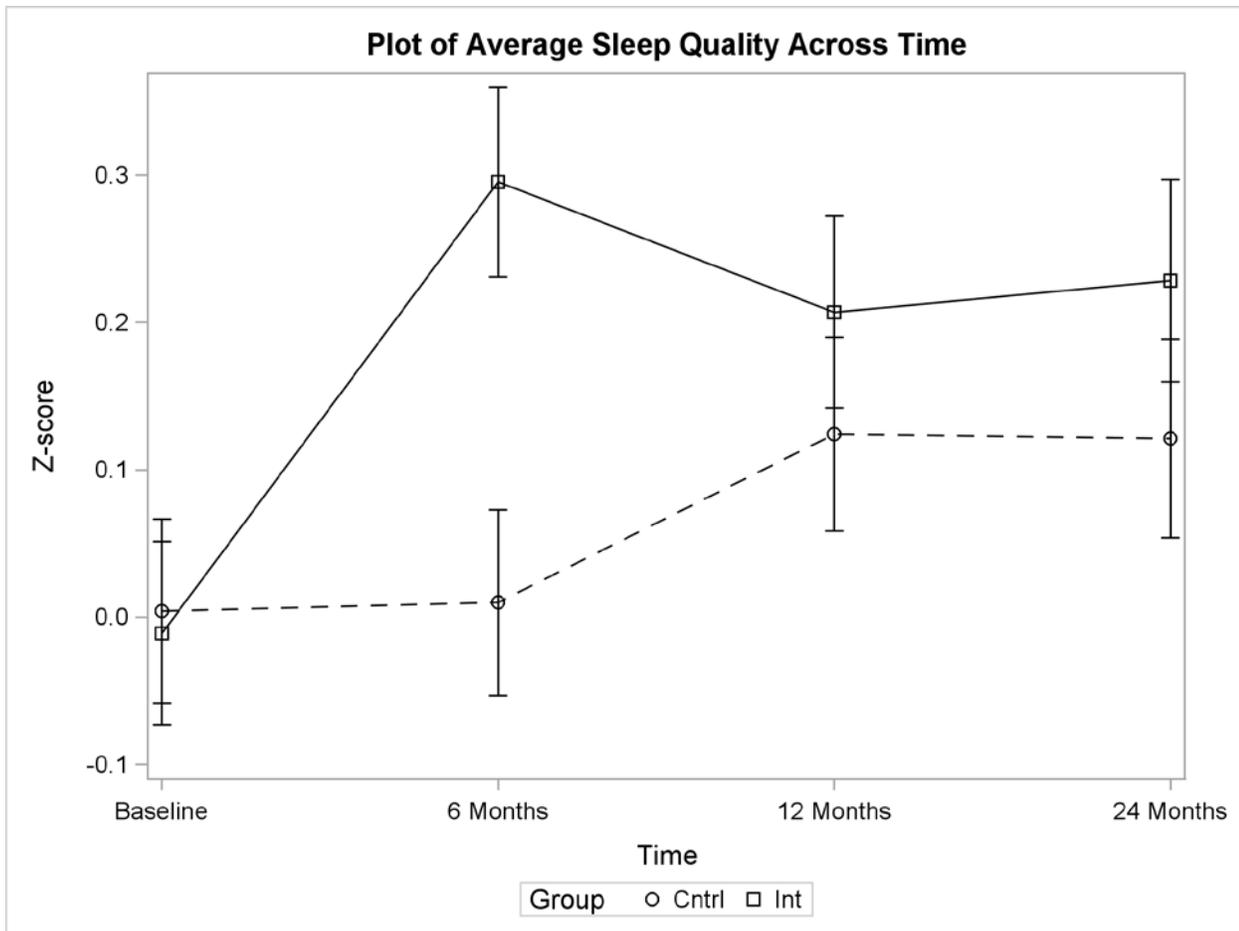


Figure 3. Average sleep quality for the intervention and control groups at each time of measurement with +/- 1 standard error bars. Higher scores indicate higher quality of sleep.

Significant program effects were observed for tobacco use at 6 and 24 months and a significant reduction of alcohol use at 12-months and marginally significant at 24 months. Effects sizes ranged from 0.10 to 0.16 for alcohol and tobacco.

Qualitative Findings

Fourteen males and 24 females participated in the group interviews, (mean age 44 years). Three major themes were observed and are shown in Table. A matrix of evolving and refined themes and representative quotes are shown in Table 2. In general, law enforcement personnel learned about the benefits of healthy nutrition, physical activity, adequate sleep quality and quantity, stress management, and reducing tobacco and heavy alcohol use. Although much could be recalled from the session and individuals made changes, the motivation for change appeared to remain external. Other than visible changes in eating habits, few personal or cultural changes assisted maintaining healthy action, and competing priorities and altered circumstances further constrained durability.

Table 2

| Finalized Durability Influences | Representative Quotes |
|---|--|
| Individuals recalled information in each content area | <p>“I agree 100% with the sleep information and the effect it has on the heart, that was news to me. I knew it was important but not that important, I guess that’s what stood out to me.”</p> <p>“I think for the games and activities stood out – um the one with the butter, where we measured things out.”</p> <p>“...Just being more aware of adding more vegetables and knowing that that small change, even just adding one more vegetable a day, can help your health.”</p> <p>“... a small change can make a difference, like just losing 5 or 6 pounds can actually change your blood pressure.”</p> <p>“The education that took place, new information, just sitting down and talking about it just raises your awareness. Like ‘oh yeah, I need to do that.’”</p> <p>“I think, in my personal opinion, I think that SHIELD was great for the office as a whole for people to recognize the education piece. For a lot of people it opened up their eyes to their habits.”</p> <p>“For me, I think I became more aware of the damage that it can do to your body by not getting proper sleep. I wasn’t aware of how the heart kind of repairs itself during the time of sleep. I was totally unaware of that.”</p> <p>“I think wearing those pedometers that we were given was actually very surprising... I was actually surprised at how much I didn’t move, so kind of an awareness or walk up call for me...”</p> <p>“I think [SHIELD] was a good start for me because it made me realize a number of things, such as how I needed to exercise more, how I needed to exercise, period. And, you know, how I need t eat better and portion control and just a number of things.”</p> |
| Differential ongoing reinforcement of behaviors | <p>“...we would bug the other people in our group about did you eat your vegetables today. . “</p> <p>“I think there has been an influence with SHIELD. Our gatherings, our office gatherings... people want fruit.”</p> <p>“[Daily walks] is one of the things that [we] tried to incorporate. One, it’s a stress reducer, and two, to get away from the office and talk. Even if it is business stuff. At least close to a mile walk each day and around mid-day to break up the monotony and stretch out the legs. It’s different and it’s work out pretty well.”</p> <p>“...with sleep you can get the least impact on group accountability, you can go like let’s go for a walk or let’s go get this kind of lunch, but you can’t be like you need to go to bed.”</p> <p>“...so compared to exercise and eating, it (sleep) is harder to control? Yeah”</p> |
| Accountability: need for external motivation once group stopped | <p>“I liked the program, I just wish there was an accountability, either an accountability piece or accountability and an external facilitator so we were accountable to somebody that was going to be checking our work or whatever.”</p> <p>“You work in a group and it kinda gives you a bit of accountability to do things. I know I haven’t been a part of those accountability things, so I probably an not as good as I should be.”</p> <p>“And the group dynamic too. I think that’s super important too because we are not only there to support each other and make better decisions and healthier decisions, but holding each other accountable too. I think it’s pretty important so I think that was something that worked.”</p> <p>“...I went back to my old habits when we weren’t meeting and talking about it. It was easier for me to slip back into my old ways when I didn’t have group participation holding me accountable.... I think I am one of those people that need structure. Without structure I easily get off track.”</p> <p>I noticed when you get away from the program and not meeting, it is more difficult to do that. You’re kind of on your own. You have knowledge, but who is going to make the choice and who is going to hold me accountable?”</p> |
| Competing demands: life events hampered | <p>“Lately we’ve had some things happening in our building. We have had Wi-Fi installed new camera systems in and looking at a new software system, so I think we have all of those things going on,</p> |

| | |
|------------------------|---|
| <p>healthy actions</p> | <p>um, we tend to not be as conscious about, you know, what we are eating.”</p> <p>“I think its when stress comes that it tend to be the debunker. If I’m late I gotta go, I can get some [food] here, someone will have something. It’s the key roadblock at times.”</p> <p>“... You get stressed out, you just grab for whatever is easiest at the time, you know.”</p> <p>“If I’m being completely honest I made changes initially but I didn’t maintain and I still haven’t gone back to that. I did weight watchers for about 4 and a half years, real successful. But vacation happened, some things happened, and I stopped doing weight watchers and right now I’m not doing so well.”</p> <p>“So for me what is difficult is I have probably read every book there is and all of that about what you should and shouldn’t do and nutrition and blah, blah, blah. But it’s different when you are working all day running around. Go to pick up kids and go from work to activity to activity to activity. You know it’s great to say I’m going to pack my little lunch box and take it all with me, but something happens in the middle of the day. You know the lunch gets left in the car and you come out three hours later and it’s all melted...”</p> |
|------------------------|---|

Discussion

Policing is a 24 hour occupation requiring shift work and multiple overtime schedules to keep our communities safe contributing to the high adverse health consequences observed among these workers. The SHIELD program was found to be feasible and in the short-term, effective in promoting the health of law enforcement officers and support personnel. Long term effects were observed for consumption of fruits and vegetables and healthier eating. The team program was well received with a high attendance and adherence to the scripted curriculum. After the 12 week intervention, significant positive changes occurred related to diet, sleep, and stress. However, only fruit and vegetable consumption and healthy eating persisted up to 24 months after the intervention.

Fruits and Vegetables

Evidence suggests diets that increase daily servings of fruits and vegetables to five per day are associated with a lower risk of chronic medical conditions, including cardiovascular disease, type 2 diabetes and cancer. A recent systematic review of worksite dietary interventions found increases in fruit and vegetable intake comparable to our findings although comparisons are limited due to the variability in instruments and how change was reported. Similar to our firefighter wellness program, significant dietary changes were observed in several areas and durable at 24 months after intervention including increased fruit consumption and vegetable consumption, and making healthy food choices. It is well documented that law enforcement personnel have increased cardiovascular disease, metabolic syndrome, diabetes, and certain cancer types as compared to U.S. adults, and these may in part be related to poor dietary habits of law enforcement personnel. The SHIELD program targeted specific dietary behavior change activities with daily and weekly goals that encouraged helping each other achieve healthy nutrition alternatives during the shift and at home. These activities included how to replace unhealthy fast food with healthy alternatives, how to shop and cook healthy on a budget, how to reduce calories in snacks, and addressing help, hype, or harm of nutritional supplement. The durability of these healthy dietary changes

persisting at 24 months among the intervention suggest the 12 week, 30 minute once per week SHIELD program changed the culture, creating a healthier culture both at work and home.

Mood, Stress, Sleep

Law enforcement personnel have a high prevalence of sleep and stress related disorders associated with adverse health outcomes including premature disability and high healthcare costs. Wellness strategies focusing on mood, stress and sleep may be critical to reducing medical costs and improving work productivity. Workplace stress is common, costly, and highly related to presenteeism, lost workdays, and a higher use of health care services. Among employees with depression, there are numerous indirect costs, loss productivity, and more than one of every three with depression develops a short-term disability during a given year. (Reduced sleep duration, especially less than 6 hours within a 24-hour period, is related to obesity, metabolic syndrome, and type 2 diabetes. In the occupational setting, chronic sleep deficits can cost as much as \$3156 per employee. A literature search yielded one study from 2006 that examined an integrated exercise and behavioral worksite intervention, which showed improvement in participant self-rated sleep quality after participation in the program. Recently, an 8 week group worksite healthy sleep program showed positive results Our SHIELD program reported significantly lower stress and improved sleep quality and quantity among the intervention group as compared to the control group at 6 months, however, these positive changes did not persist at 24 months.

Knowledge and Change

Although not often mentioned, an individual's knowledge relates to the change processes, as it is integral to perceived susceptibility, norms, and expectancies. While conventional thought is that knowledge alone does not change behavior, it may have an important permissive role, as interventions relying on social support are more effective when education is included. For example, in a meta-analysis of studies with unpaid family caregivers, those that combined education with social support produced the largest effects for improved well-being. This differs from the common wisdom that knowledge about adverse risks is not a predictor of health behavior, and programs that are knowledge-based do not impact actions. However, as seen in marketing, certain information can have the ability to persuade.

Teams and social support

A review of studies indicated that social support from co-workers can have positive influences on affect, coping, absenteeism, job turnover and well-being. The power of positive influence by simply observing others working towards a goal can motivate people to pursue the same goal, especially if incorporated in a team setting. In our previous PHLAME study, positive changes persisted for years after the intervention and appeared to diffuse, postulating a tipping point

where culture change occurred and became the norm. These findings were associated with firefighters' team orientation, enacted healthy norms, and competitiveness regarding the results of annual health assessments. The original intervention trial appeared to initiate individual change that coalesced into group effects. Secondary influences included increasing public awareness about health, newly hired younger firefighters, and a modicum of administrative support. Culture shift was achieved at the workplace. We observed the same durability effect for long term healthy dietary change among our law enforcement personnel who participated in the 30 minute, once per week for 12 week SHIELD intervention program as compared to the control group who received the same 6 month testing and test results with physician advice.

Single Focus versus Multiple Intervention Targets

It has been suggested that interventions that focus on multiple behaviors have a greater impact on public health than single-behavior interventions due to additive or synergistic effects when intervening simultaneously. In addition, Kremers et al found evidence that mediators of behavior change for different health behaviors may cluster more strongly than the behaviors themselves, indicating that a simultaneous approach may be advisable.

The Synergy Hypothesis posits that goals are organized in associative cognitive networks where an overarching goal, such as improved health, has sub goals, e.g., more physical activity and eating more fruits and vegetables, so that pursuing a sub goal can spread activation and reinforce the overriding goal. On the other hand, simultaneous interventions may be overwhelming, too time demanding, may fail to address any single behavior in sufficient depth and reduce intervention adherence. Focusing on different behaviors sequentially at different points in time is associated with less cognitive effort, and program behavioral goals were delivered in sequence. Because behavior change is an effortful process, the sequential approach that was used in the SHIELD program enables these behaviors to become automatic habits that lack substantial drain on self-regulatory resources.

Qualitative findings

Qualitative interviews revealed explanatory factors relating to the observed durability of positive behavioral outcomes. Findings suggest the interventions' specific and memorable information was comparable in its retention by participants. However, the ability for sustained reinforcement of the momentum achieved varied based on the behaviors modeling, encouragement and norms. For eating behaviors that reinforcement appeared to sustain the change. To sustain invisible behaviors specific means, such as environmental cues, self-monitoring and booster content may be needed for maintenance.

Conclusions

Law enforcement personnel are a high-risk group for occupational injuries and illnesses, resulting in a life expectancy less than the average American. Few law enforcement organizations have health promotion/harm reduction programs, despite a demonstrated need and predictions that occupational wellness is a critical component of recruiting and maintaining an effective workforce. This randomized prospective trial assessed the feasibility and efficacy of a team-based worksite health and safety intervention among law enforcement departments and personnel. The SHIELD program conducted weekly, peer-led sessions delivered from a scripted team-based on health and safety topics including exercise, nutrition, stress, sleep, body weight, injury, and other unhealthy lifestyle behaviors such as smoking and heavy alcohol use. Health and safety questionnaires administered before and after the intervention found significant improvements for increased fruit and vegetable consumption, decreased dietary fat consumption, overall healthy eating, increased sleep quantity and sleep quality, and reduced personal stress at 6 months post intervention. This study demonstrates that a team-based, peer-led scripted health promotion program for law enforcement personnel incorporated into their daily work routine is both feasible and may be ideally suited to harness positive peer pressure to improve the health and safety of law enforcement personnel. While many studies among law enforcement workers highlight the adverse health outcomes faced by those in this profession, this study is promising in that it suggests that tailored lifestyle and behavior change interventions could counter the adverse health effects associated with work in law enforcement and reduce the economic costs associated with those risk.

Inclusion of Children:

Not applicable

Materials available for other investigators:

Nothing developed

Inclusion Enrollment Table (insert here)

Publications

Manuscripts

1. Kuehl KS, Elliot DL, Goldberg L, MacKinnon DP, Vila BJ, Smith J, Miočević M, O'Rourke HP, Valente M, DeFrancesco C, Sleigh A, McGinnis W. The Safety and Health Improvement: Enhancing Law Enforcement Departments study: feasibility and findings. *Frontiers Public Health* (2014) ;2:1-7.
2. Elliot D, Garg B, Kuehl K, DeFrancesco C, Sleigh A. "Why are Women Law Enforcement Officers More Burned-out and what Might Help them?". *Occup Med Health Aff* (2015) 3:204. doi: 10.4172/2329-6879.1000204
3. Kuehl KS, Elliot DL, MacKinnon DP, O'Rourke HP, DeFrancesco C, Miočević M, Valente M, Sleigh A, Garg B, McGinnis W, Kuehl H The SHIELD (Safety & Health Improvement: Enhancing Law Enforcement Departments) Study: Mixed Methods Longitudinal Findings. *JOEM*, in press.
4. Garg B, Kuehl K, Elliot D, DeFrancesco C, Sleigh A, McGinnis A, Kuehl H. Physical activity, sleep and metabolic syndrome in law enforcement officers. *Journal: Safety and Health at Work*, in submission Oct 2015

Abstracts

1. Elliot DL, Kuehl KS, Garg B, et al. Why are women police officers more burned-out and what would help them? Data from Baseline SHIELD Study. Presented National Society Behavioral Medicine meeting; San Francisco, CA, March 21, 2013.
2. Kuehl KS, Elliot DL, MacKinnon D, et al. Are law enforcement officers fit for duty? Data from Baseline SHIELD Study. Presented National Society Behavioral Medicine meeting; San Francisco, CA, March 23, 2013.
3. Garg B, Kuehl KS, Elliot DL, et al. Physical inactivity associated with metabolic syndrome in law enforcement officers. Data from Baseline SHIELD Study. Presented National Society Behavioral Medicine meeting; San Francisco, CA, March 23, 2013.
4. Kuehl KS, Elliot DL, MacKinnon D, et al. The SHIELD (Safety & Health Improvement: Enhancing Law Enforcement Departments) Pilot Study Results: Feasibility & Findings. Presented at the American College of Occupational Medicine Meeting, Los Angeles, CA, May 20, 2012.
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6. Wurpts, I. C., O'Rourke, H. P., MacKinnon, D. P, Elliot, D., & Kuehl, K. Mediators of intervention effects on law enforcement officers' job burnout. In K. Goldsmith (Chair), Modern methods for mediation analysis in prevention. Society for Prevention Research, San Francisco, CA. Submitted Oct. 2015.