



Effective Public Health Practice Project



The Effectiveness of Multi-faceted Health Promotion Interventions in the Workplace to Reduce Chronic Disease

April 2007

**Funded by the
Ontario Ministry of Health and Long Term Care
and
Hamilton Public Health Services PHRED Program**

Hamilton Public Health Services

Kingston, Frontenac and Lennox
& Addington Health Unit

Middlesex-London Health Unit

Sudbury & District Health Unit

Ottawa Public Health

Ontario Ministry of Health and
Long-Term Care



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April 2007

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Effective Public Health Practice Project (EPHPP) Reviews and Summary Statements (1999-2006)

To determine the effectiveness of interventions included in the Mandatory Health Programs and Services Guidelines (MHPSG), the following systematic reviews and summary statements were completed. Funding for the project has been provided by the Public Health Research, Education and Development (PHRED) Program of the Public Health Branch, Ministry of Health and Long-Term Care and Public Health Services in the City of Hamilton, Ontario, Canada.

GENERAL STANDARDS

Equal Access

Health Hazard Investigation

- New roads and human health: A systematic review 2005
- Effectiveness of public health in organized response to non-natural environmental disasters * 1999
- Effectiveness of environmental awareness interventions * 1999

Program Planning and Evaluation

- Psychosocial and psychological interventions for preventing postpartum depression 2005
- Effectiveness of physical activity programs at worksites with respect to work-related outcomes 2005
- Meta-analysis of psychosocial interventions for caregivers of people with dementia 2005
- Health related virtual communities and electronic support groups: Systematic review of the effects of online peer-to-peer interactions 2005
- Web sites for promoting health 2003
- The effectiveness of patient diabetes education in the management of type 2 diabetes 2002
- The effectiveness of on-line health information for consumers 2002
- Mass media interventions: Effects on health services use 2001
- A meta-analysis of fear appeals: Implications for effective public health campaigns 2001
- Electronic social support groups to improve health * 2000
- Effectiveness of video for health education 2000

CHRONIC DISEASE AND INJURIES

• Effectiveness of environmental awareness interventions *	1999
Chronic Disease Prevention	
• The effectiveness of intervention to promote physical activity among marginalized populations	2006
• Competitions and incentives for smoking cessation	2006
• Enhancing partner support to improve smoking cessation	2006
• Group behaviour therapy programmes for smoking cessation	2006
• Individual behavioural counselling for smoking cessation	2006
• A review of interventions to reduce tobacco use in colleges and universities	2006
• Physician advice for smoking cessation	2006
• Workplace interventions for smoking cessation	2006
• Exercise for health for early postmenopausal women: A systematic review of randomized controlled trials	2006
• Home versus center based physical activity programs in older adults	2006
• Interventions for promoting physical activity	2006
• The effectiveness of school-based interventions in reducing adolescent risk behaviours: A systematic review of reviews*	2005
• The effectiveness of interventions to prevent excessive weight gain in pregnancy*	2005
• Dietary advice given by a dietician versus other health professionals or self-help resources to reduce blood cholesterol	2005
• A review of 25 long-term adolescent tobacco and other drug use prevention program evaluations	2005
• Counselling to promote a healthy diet in adults: A summary of evidence for the US Preventive Services Task Force	2005
• Reviews of evidence on interventions to prevent dental caries, oral and pharyngeal cancers, and sports-related craniofacial injuries	2005
• Systematic review of long-term effects of advice to reduce dietary salt in adults	2005
• Effectiveness of physical activity enhancement and obesity prevention programs in children and youth (Healthy Weights Review (HWR))*; comprised of the following five reviews:	2004
• Environmental interventions to improve nutrition and increase physical in children and youth	
• Interventions to improve nutritional intake in children and youth	
• Interventions to increase physical activity and nutritional intake in children and youth	
• Interventions to increase physical activity in children and youth	
• Interventions to reduce physical inactivity in children and youth	
• Effectiveness of worksite physical activity programs on physical activity, physical fitness and health	2004
• Exercise to improve self-esteem in children and young people	2004
• Mass media interventions for preventing smoking in young people	2004
• Exercise as an aid in smoking cessation	2004
• Young people and healthy eating: A systematic review on barriers and facilitators	2003
• The effectiveness of routinely taught breast self-examination in reducing mortality	2003
• The effectiveness of patient diabetes education in the management of type 2 diabetes	
• The effectiveness of school-based strategies for the primary prevention of obesity and for promoting physical activity and/or nutrition, the major modifiable risk factors for type 2 Diabetes*	2002
• Effectiveness of primary prevention of eating disorders *	2001
• Using school-based programs to improve heart healthy eating behaviours of children	2001
• Effectiveness of interventions to promote healthy eating in pre-school children aged 1 to 5 years	2001
• Effectiveness of smoking cessation interventions	2001
• Limited (information only) patient education programs for adults with asthma	2001
• The effectiveness of health promotion interventions in the workplace	2001
• The effect of exercise training on bone mass among pre- and postmenopausal women	2001
• The effectiveness of the health promoting schools approach and school-based health promotion interventions	2001
• Effectiveness of home based support for older people	2001
• The effectiveness of school-based interventions in promoting physical activity and fitness among children and youth: A systematic review *	2001
• Effectiveness of dust mite control to reduce asthma symptoms	2000

- The effectiveness of interventions for preventing tobacco smoke in public places 2000
 - Effectiveness of a telephone intervention as a delivery strategy within the scope of public health nursing practice 2000
 - The effectiveness of postpartum smoking relapse prevention strategies: A systematic review of the evidence 1992-1999* 2000
 - The effectiveness of community interventions to increase fruit and vegetable consumption in people four years of age and older * 1999
 - Effectiveness of coalitions in heart health promotion, tobacco use reduction, and injury prevention: a systematic review of the literature 1990-1998 * 1999
 - Smoking cessation during pregnancy 1999
 - The effectiveness of community-based heart health programs: a systematic overview update * 1999
 - The effectiveness of workplace-based health risk appraisal in improving knowledge, attitudes or behaviours 1999
- Early Detection of Cancer**
- The effectiveness of interventions to promote mammography among women with historically lower rates of screening 2005
 - Effectiveness of strategies to increase cervical cancer screening in clinic-based settings: A systematic review of the literature 1989-1999 * 2000
 - Community-based strategies to promote cervical cancer screening * 2000
- Injury Prevention Including Substance Abuse Prevention**
- Home visits during pregnancy and after birth for women with an alcohol or drug problem 2006
 - Non-legislative interventions for the promotion of cycle helmet wearing by children 2006
 - Interventions for promoting booster seat use in four to eight year olds traveling in motor vehicles 2006
 - Population-based interventions for the prevention of fall-related injuries in older people 2006
 - School-based driver education for the prevention of traffic crashes 2005
 - A systematic review of the effectiveness of the community reinforcement approach in alcohol, cocaine and opioid addiction 2005
 - A review of 25 long-term adolescent tobacco and other drug use prevention program evaluations 2005
 - Post-license driver education for the prevention of road traffic crashes 2004
 - A meta-analysis of fall prevention programs for the elderly: How effective are they? 2004
 - Interventions to prevent the recurrence of elder abuse 2003
 - The effectiveness of preventative home visits to elderly people living in the community 2003
 - Interventions for increasing pedestrian and cyclist visibility 2003
 - Child pedestrian safety 2003
 - The effectiveness of physical exercise for sleep problems in adults aged 60+ 2002
 - Effectiveness of a telephone intervention as a delivery strategy within the scope of public health nursing practice 2000
 - Effectiveness of video for health education 2000
 - Effectiveness of anticipatory care interventions with community-dwelling elderly persons 2000
 - Effectiveness of coalitions in heart health promotion, tobacco use reduction, and injury prevention: a systematic review of the literature 1990-1998 * 1999
 - Prevention of unintentional injuries in childhood and young adolescence 1999
 - Effectiveness of school-based programs in reducing adolescent risk behaviour: a systematic review of reviews * 1999
 - The effectiveness of school-based curriculum suicide prevention programs for adolescents * 1999

FAMILY HEALTH

Sexual Health

- Women, sex and HIV 2004
- The effectiveness of public health interventions to reduce or prevent spousal abuse toward women * 2001
- The effectiveness of the health promoting schools approach and school-based health promotion interventions 2001
- Peer health promotion interventions for youth 2000
- Effectiveness of school-based programs in reducing adolescent risk behaviour: a systematic review of reviews * 1999

- A systematic review of the effectiveness of adolescent pregnancy primary prevention programs* 1999
- A systematic review of the effectiveness of primary prevention programs to prevent sexually transmitted diseases (STDs) in adolescents* 1999

Reproductive Health

- Home visits during pregnancy and after birth for women with an alcohol or drug problem 2006
- The effectiveness of interventions to prevent excessive weight gain in pregnancy* 2005
- The effectiveness of folate supplementation for the prevention of neural tube defects 2002
- Antenatal education for childbirth/parenthood 2001
- The effectiveness of public health strategies to reduce or prevent the incidence of low birth weight in infants born to adolescents: A systematic review * 2001
- The effectiveness of postpartum smoking relapse prevention strategies: A systematic review of the evidence 1992-1999* 2000
- Smoking cessation during pregnancy 1999
- The effectiveness of home visiting as a delivery strategy for public health nursing interventions to clients in prenatal and postnatal period: A systematic review * 1999

Child Health

- The effectiveness of early childhood home visitation in preventing violence: a systematic review 2006
- The effectiveness of school-based interventions in reducing adolescent risk behaviours: A systematic review of reviews* 2005
- Reviews of evidence on interventions to prevent dental caries, oral and pharyngeal cancers, and sports-related craniofacial injuries 2005
- Social deprivation and the prevention of unintentional injury in childhood. A systematic review 2005
- Optimal duration of exclusive breastfeeding 2002
- Community-based interventions to improve child mental health: review of reviews* 2002
- The effectiveness of school social work from a risk and resilience perspective 2002
- The effectiveness of school-based violence prevention programs for children at risk 2002
- The effectiveness of public health interventions to reduce or prevent spousal abuse toward women * 2001
- The effectiveness of the health promoting schools approach and school-based health promotion interventions 2001
- Support for breastfeeding mothers 2001
- Effectiveness of pre-school screening for hearing, speech, language and vision 2001
- Antenatal education for childbirth/parenthood 2001
- Parent-training programmes for improving maternal psychosocial health 2001
- Effectiveness of a telephone intervention as a delivery strategy within the scope of public health nursing practice 2000
- Effectiveness of video for health education 2000
- The effectiveness of postpartum smoking relapse prevention strategies: A systematic review of the evidence 1992-1999* 2000
- Promotion of healthy feeding in infants under one year of age 2000
- Smoking cessation during pregnancy 1999
- Effectiveness of school-based programs in reducing adolescent risk behaviour: a systematic review of reviews * 1999
- A systematic review of the effectiveness of peer/paraprofessional 1:1 interventions targeted towards mothers (parents) of 0-6 year old children * 1999
- Effectiveness of parenting groups with professional involvement in improving parent and child health/development outcomes * 1999
- The effectiveness of home visiting as a delivery strategy for public health nursing interventions to clients in prenatal and postnatal period: A systematic review * 1999
- The effectiveness of school-based curriculum suicide prevention programs for adolescents * 1999

INFECTIOUS DISEASES

- Bioterrorism preparedness 2003
- The effectiveness of needle exchange programs in modifying HIV-Related outcomes: A systematic review of the evidence 1997-1999* 2000

Control of Infectious Diseases	
• The effectiveness of methoprene for controlling mosquito populations in Ontario that can carry West Nile Virus	2004
Food Safety	
• Effectiveness of food safety interventions *	2001
• Food safety in community-based settings	1999
Infection Control	
• Effective infection control interventions in day care centres	1999
Rabies Control	
Safe Water	
Sexually Transmitted Diseases	
• Review and meta-analysis of HIV prevention intervention research for heterosexual adult populations in the United States	2005
• Effectiveness of video for health education	2000
• A systematic review of the effectiveness of primary prevention programs to prevent sexually transmitted diseases (STDs) in adolescents*	1999
• The effectiveness of needle exchange programs in modifying HIV-Related outcomes: A systematic review of the evidence 1997-1999*	1999
Tuberculosis Control	
• Enhancing adherence to tuberculosis treatment	1999
Vaccine Preventable Diseases	
• Vaccines for preventing influenza in healthy children	2006
• Effect of patient reminder/recall interventions on immunization rates	2001
• The effectiveness of the health promoting schools approach and school-based health promotion interventions	2001

** indicates a review completed by the Effective Public Health Practice Project. Completed reviews and summary statements are added to our web site as they become available. Please check <http://www.hamilton.ca/phcs/ephpp/> regularly for new or updated information.*

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PREFACE

Research is one component in evidence-based decision-making, along with past experience, patient preference, and available resources. Making research results available to consumers, practitioners, policy-makers, and other researchers is essential to fostering evidence-based practice and decision-making. In the Ontario Public Health, Health Promotion and Primary Care area, lack of access to research evidence can be a barrier to using research in policy and practice (Ciliska, Hayward, Dobbins, Brunton & Underwood, 1999; Camiletti & Huffman, 1998).

The Public Health Branch of the Ministry of Health and Long-Term Care and the City of Hamilton fund the Public Health Research, Education and Development (PHRED) Program in Hamilton. A similar program is in place in four other health units across the province. One role of the PHRED Program is to conduct and disseminate clinically relevant public health, health promotion and primary care research, and to foster evidence-based practice and policy-making.

The Effective Public Health Practice Project (EPHPP) is one initiative within the PHRED Program. This project involves public health researchers, practitioners, and policy-makers from across the province. The EPHPP project members conduct systematic reviews that evaluate the effectiveness of relevant interventions. This project, co-ordinated from the City of Hamilton PHRED, has produced numerous reviews and summary statements on the effectiveness of interventions for the Ministry of Health and Long-Term Care, Public Health Branch. Work is ongoing.

Professional collaboration ensures high-quality scientific work that is clinically relevant to consumers, practitioners, and policy-makers. Members of the PHRED Program located in each of the health units have links with faculties such as health sciences, dentistry, nursing, nutrition, medicine, environmental health and geography at their local universities. The EPHPP also has links to the Cochrane Collaboration, an international research initiative, committed to summarizing and making the highest quality research available world-wide.

The EPHPP is committed to on-going consultation with health units within the province to define and review appropriate public health topics, and to collaboration with other groups equally committed to evidence-based practice and decision-making. In this way, the EPHPP continues to develop research that is timely, evidence-based, and relevant to the delivery of public health services in Ontario.

SUMMARY STATEMENT



Effective Public Health Practice Project Summary Statement

Date April, 2007

Review on which this summary statement is based:

Micucci, S., Thomas, H. (2007). The effectiveness of multi-faceted health promotion interventions in the workplace to reduce chronic disease. Effective Public Health Practice Project.

Review Content Summary:

The systematic review of randomized controlled trials (RCTs) was conducted to determine the effectiveness of multi-faceted studies in the workplace to reduce the chronic diseases cardiovascular disease, cancer, chronic obstructive lung disease, and diabetes, or their risk factors. Eleven multi-faceted studies and two sub-studies were found to be relevant. Two sub-studies were embedded in a larger study and were reported as separate studies for the reason that each added an additional component to the main intervention. One study compared two intervention groups to a control group and was reported separately where appropriate. Three studies looked at interventions combining nutrition and physical activity, two studies focused on nutrition and smoking cessation, and eight studies combined nutrition, physical activity and smoking cessation. Findings support the distribution of educational material and professional instruction to increase the likelihood of adopting healthy eating practices, increasing physical activity and decreasing smoking.

Comments on this Review's Methodology: This is a methodologically strong review. The literature search included health and psychological databases, abstracts of conferences, and web sites of governments of industrial countries, and academic institutions in the field of workplace health. As well, key journals and the references of relevant papers were searched and articles were identified by the working group. The reviewers' assessment of methodological quality included six criteria: selection bias, allocation bias, control of confounders, blinding of outcome assessors, data collection methods and withdrawals and dropouts. Data were extracted from all relevant studies. Given the heterogeneity of the populations, the weak quality of the studies, and the multiple intervention features and outcome measures the data was summarized in a narrative format (Deeks, Higgins, & Altman, 2006).

Why this issue is of interest to public health:

The four chronic diseases, cardiovascular disease including coronary artery disease and stroke, cancer, chronic obstructive lung disease, and diabetes are responsible for two-thirds of total deaths in Canada (Standing Senate Committee on Social Affairs, Science and Technology, 2002). The total cost of disability and death due to chronic

disease on the health care system is greater than \$80 billion annually (Intersectoral Healthy Living Network, 2005). Poor nutrition, physical inactivity and tobacco use have been recognized as the leading social/behavioural risk factors for these chronic diseases in Canada. Ninety-six percent of adults 18-74 years of age have a modifiable risk factor for cardiovascular disease. Twenty-one percent of Canadians 15+ smoke, only about 30 percent of Canadians are physically active and over 50 percent of Canadians are overweight (Chronic Disease Prevention Alliance of Canada, 2007). Through the Mandatory Health Programs and Services Guidelines (Ministry of Health and Long-Term Care, 1997), a requirement and standard for public health under the Chronic Diseases and Injuries Program is to “work with workplace personnel and local trade and business associations to improve awareness, skill development and the work environment to reduce the risk of chronic diseases. Topics must include one or more of the following: tobacco-free living, healthy eating, healthy weights and regular physical activity” (p16). The purpose of this systematic review of the literature is to provide evidence-based direction for policy in compliance with these guidelines.

Evidence points are not weighted or ranked

What's the evidence?	Implications for practice and policy
<ul style="list-style-type: none"> ➤ Interventions incorporating the distribution of educational material and professional instruction were more successful than interventions that did not 	<ul style="list-style-type: none"> ➤ Public health practitioners should partner or offer their services to workplaces to ensure that educational material and instruction is applicable and of high quality
<ul style="list-style-type: none"> ➤ The heterogeneity of the populations, interventions and outcome measures made it problematic to compare studies. Interventions that were conducted in a single workplace were not repeated and the results of interventions conducted over multiple workplaces could not be associated with a particular type of workplace 	<ul style="list-style-type: none"> ➤ Investigators should concentrate on implementing interventions on similar populations multiple times before expanding their sample population to determine if interventions are worksite specific or can be generalized ➤ Investigators conducting interventions in multiple worksites should consider reporting details and outcomes of single worksites to determine if the intervention is worksite specific or can be generalized
<ul style="list-style-type: none"> ➤ All studies scored Weak for methodological quality. Selection Bias, Blinding and Participation scored the lowest of all criteria 	<ul style="list-style-type: none"> ➤ Participation rates at the workplace level might increase if industry were informed of the economic benefits of incorporating health promotion at the worksite ➤ Investigators should look to agencies such as public health to implement interventions so that the investigators can reduce bias due to the inability to be blinded

<ul style="list-style-type: none"> ➤ No studies reported a chronic disease as an outcome measurement. All studies reported on multiple intermediate outcome biomarkers for chronic diseases or behaviours that affect these biomarkers ➤ No studies were successful at improving all outcome measures they reported 	<ul style="list-style-type: none"> ➤ Outcomes reported should be limited to chronic diseases, intermediate outcome biomarkers that affect chronic disease or their risk factors that are scientifically shown to be influenced by behaviour
<ul style="list-style-type: none"> ➤ Studies reporting outcomes nine months or less from commencement were more successful than studies reporting outcomes twelve months or later ➤ Studies reporting outcomes at twelve months or later showed that many outcomes improved initially then returned to baseline 	<ul style="list-style-type: none"> ➤ Although there is short-term gain, long term benefits have not yet been demonstrated

General Implications:

- Public health practitioners need to work with public, private, and not-for-profit organizations to ensure high quality educational material and instruction are offered at worksites
- Investigators should take into consideration the agencies that would be providing the educational material and instruction in the long run and incorporate them in the intervention
- The workplace is a complex venue to promote health. It is important to acknowledge the challenge of meeting the needs of all size workplaces, all industrial classifications, public/private/not-for-profit sectors in many geographical locations
- Interventions must take into consideration that the workplace is constantly evolving with many changes to the traditional definition of work and where it is performed, for example telework options, compressed work week, removal of mandatory retirement legislation etc.
- Public, private and not-for-profit organizations need to realize that health promotion is a long-term commitment that has been shown to reduce sick leave, absenteeism, and workers' compensation and disability costs thereby increasing productivity (Chapman, 2005 & Pelletier, 2005)

Cost Benefit or Cost-effectiveness Information

Cost benefit and cost-effectiveness outcomes were included in one study (Proper et al, 2004). Intervention costs were compared to reduced sick leave. The cost benefit results were then compared to the resulting effects of the intervention (physical activity, energy expenditure, cardio respiratory fitness). The net total costs for the intervention period were 305 EU. The net total benefits for the same period the following year were 205 EU. The intervention was cost-effective for energy expenditure and cardio respiratory fitness only. Other reviews have investigated economic outcomes for workplace interventions and in most cases found a reduction in absenteeism, sick leave, health plan costs, workers' compensation and disability for a net total benefit (see Chapman, 2005, Pelletier, 2005).

References Used to Outline Issue:

Chapman, L.S., (2005). Meta-evaluation of worksite health promotion economic return studies: 2005 update. *The Art of Health Promotion*, 4, 1-11.

Deeks, J.J., Higgins, J.P.T., Altman, D.G., editors. (2006). Analysing and presenting results. In: J.P.T. Higgins, & S. Green, editors. *Cochrane Handbook for Systematic Reviews of Interventions 4.2.6* [updated September 2006]; Section 8. Retrieved March 10, 2007 from <http://www.cochrane.org/resources/handbook/hbook.htm>.

Intersectoral Healthy Living Network. (2005). *The integrated pan-Canadian healthy living strategy*. Ottawa: Minister of Health. Retrieved from http://www.healthcouncilcanada.ca/docs/rpts/2006/References_HCC_2006_AnnualReport.pdf on March 10, 2007.

Ministry of Health and Long-Term Care, Public Health Division. (1997). *Mandatory Health Programs and Service Guidelines*. Retrieved March 10, 2007, from <http://www.health.gov.on.ca/english/providers/pub/pubhealth/manprog/manprog.html>.

Pelletier, K.R. (2005). A review and analysis of the clinical and cost-effectiveness studies of comprehensive health promotion and disease management programs at the worksite: update VI 2000-2004. *Journal of Occupational and Environmental Medicine*, 47, 1051-1058.

Standing Senate Committee on Social Affairs, Science and Technology. (2002). *The Health of Canadians – The Federal Role*. Volume 6. Retrieved March 10, 2007 from <http://www.parl.gc.ca/37/2/parlbus/commbus/senate/com-e/SOCI-E/rep-e/repoct02vol6-e.htm>.

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The format of this summary statement has been adapted from health-evidence.ca (www.health-evidence.ca)

ABSTRACT

Objectives

The objective of this systematic review is to present the evidence on the effectiveness of multi-faceted health promotion interventions in the workplace to reduce the chronic diseases, cardiovascular disease including coronary artery disease and stroke, cancer, chronic obstructive lung disease and diabetes, or their risk factors and the components and characteristics of these interventions.

Methods

The search strategy followed the guidelines set out by the “Cochrane Reviewers Handbook 4.1.4” (*The Cochrane Library*, 2001). Electronic databases were searched from 1990 to 2006. In addition websites of governments of industrialized countries, academic institutions and relevant organizations were searched for non-published studies. Relevant peer-reviewed journals were hand-searched, reference lists of all relevant articles were reviewed and authors and articles were identified by the working group. Standardized tools were used by two reviewers to independently rate each article for relevance and methodological quality. Data extraction from all articles was completed using a standardized instrument.

Results

Eleven multi-faceted studies and two sub-studies were found to be relevant. Two sub-studies were embedded in a larger study and were reported as separate studies because each added an additional component to the main intervention. Three studies looked at interventions combining nutrition and physical activity, two studies focused on nutrition and smoking cessation, and eight studies combined nutrition, physical activity and smoking cessation. All studies scored weak for methodological quality. Data were extracted from all studies.

Of the thirteen outcomes showing a statistically significant improvement, interventions incorporating the distribution of educational material and professional instruction were more successful than interventions that did not. Studies reporting outcomes nine months or less from commencement were more successful than studies reporting outcomes twelve months or later. Studies reporting outcomes at twelve months or later showed that many outcomes improved initially then returned to baseline.

Conclusions

There are many limitations to the studies included in this systematic review; therefore, there are limitations to this systematic review. The overall quality of the studies is weak specifically in the areas of Selection Bias, Blinding and Allocation Concealment.

In general, at the individual level, interventions that incorporated the distribution of educational material and professional instruction were more successful than interventions that did not. Longer follow-up periods are necessary to determine if these components are successful in the long-term. At the workplace level, one study reported on behaviours at the organizational level outcomes. These behaviours did not translate into an improvement of biomarkers or behaviours. There is insufficient evidence to recommend or not recommend multi-faceted strategies at the organizational level for the primary prevention of chronic disease.

INTRODUCTION

Through the Mandatory Health Programs and Services Guidelines (Ministry of Health and Long-Term Care, 1997), a requirement and standard for public health under the Chronic Diseases and Injuries Program is to “work with workplace personnel and local trade and business associations to improve awareness, skill development and the work environment to reduce the risk of chronic diseases. Topics must include one or more of the following: tobacco-free living, healthy eating, healthy weights and regular physical activity” (p16). The purpose of this systematic review of the literature is to provide evidence-based direction for programming and policy in compliance with these guidelines.

This review will focus on the four chronic diseases responsible for two-thirds of total deaths in Canada; cardiovascular disease including coronary artery disease and stroke, cancer, chronic obstructive lung disease and diabetes (Standing Senate Committee on Social Affairs, Science and Technology, 2002). The World Health Organization estimates that 72 percent of the deaths in Canada are caused by these four chronic diseases. As well, the total cost of disability and death due to chronic disease on the health care system is greater than \$80 billion annually (Intersectoral Healthy Living Network, 2005).

Poor nutrition, physical inactivity and tobacco use have been recognized as the leading social/behavioural risk factors for these chronic diseases in Canada. Ninety-six percent of adults 18-74 years of age have a modifiable risk factor for cardiovascular disease. Twenty-one percent of Canadians 15+ smoke, only about 30 percent of Canadians are physically active and over 50 percent of Canadians are overweight (Chronic Disease Prevention Alliance of Canada (CDPAC), 2007).

The workplace is an ideal forum for reaching the majority of adults. Sixty-eight percent of Canadians over 15 years of age are employed or are actively looking for work (Labour Force Survey, 2007). As well, a significant amount of time is spent in the workplace and many workplaces already have incorporated an infrastructure to support health and safety.

BACKGROUND

The four major chronic diseases: cardiovascular disease, cancer, chronic obstructive lung disease and diabetes, share many of the same risk factors. As well, individuals may be at risk for more than one of these diseases at the same time (CDPAC, 2007). Taking this into consideration a search of the literature was performed for systematic reviews addressing more than one risk factor for chronic disease. The following five systematic reviews have been recently performed in the area of worksite interventions that address more than one risk factor for chronic disease.

The most recent systematic review included a literature search to February 2005. Fifty-six articles met the inclusion criteria. Of a maximum score of 35 for the methodological quality of the included studies, two studies scored 28, two studies scored 26, and the remaining studies scored 25 or lower. The lowest score was 12.

Only economic outcomes were reported. Results showed varying rates of decrease in sick leave, health costs, compensation/disability costs and cost/benefit ratio (Chapman, 2005).

The sixth update of a review of comprehensive health promotion and disease management programs at the worksite reported on eight studies published between 2000 and 2004. All studies took place in the United States. One study was a randomized controlled trial (RCT). The update was reported as consistent with the previous review that showed “evidence of positive clinical and cost outcomes”. This evidence was not readily apparent. Of the eight studies, clinical outcomes were only reported in two studies. Smoking cessation rates did not increase in the intervention group in one study and the obesity rates increased in the intervention group in another study. Only economic outcomes were reported for the remaining six studies. The author also commented that there has been a noticeable deterioration in both the methodological quality and quantity of studies to prevent chronic disease in the workplace published since 2000 (Pelletier, 2005).

The third review reported on worksite health promotion programs that incorporated an environmental change. Thirteen RCTs of mostly poor quality published before January 2004 looked at interventions addressing a single risk factor (n=5) and multiple risk factors (n=8). Environmental modifications to influence dietary intake occurred in nine studies and to modify dietary intake and physical activity in four studies. The authors concluded that there was strong evidence of interventions with environmental modifications for improving nutrition, inconclusive evidence for increasing physical activity and no evidence for ameliorating health risk factors (Engbers, Van Poppel, Chin, Paw, & Van Mechelen, 2005).

Policy and environmental interventions that promote physical activity and nutrition for cardiovascular health published up to October 2003 were the focus of the fourth review. Three pre/post studies published after 1990 addressed more than one risk factor. The multi-faceted interventions were reported with the single-faceted interventions so no conclusion can be made on the effectiveness of multi-faceted interventions (Matson-Koffman, Brownstein, Neiner, & Greaney, 2005).

Obesity and overweight were the outcomes measured in a systematic review of literature published to 2001. On the basis of seven of the twenty studies, the authors recommended worksite interventions combining nutrition and physical activity to control overweight and obesity. All seven studies were published before 1990 (Katz et al., 2005).

In summary, five reviews on multi-faceted interventions in the workplace to reduce chronic disease were located. All five reviews have limitations: two reviews restricted outcomes to economic measures, one review limited studies to those conducted in the United States, two reviews limited studies to interventions incorporating an environmental component, and one review based their conclusion on studies published before 1990. The objective of this review is to remove those restrictions and update the literature on workplace interventions to reduce chronic disease.

RESEARCH QUESTIONS

1. Do multi-faceted health promotion interventions in the workplace reduce the chronic diseases cardiovascular disease including coronary artery disease and stroke, cancer, chronic obstructive lung disease and diabetes, or their risk factors?
2. What are the components and characteristics of successful multi-faceted health interventions in the workplace for the primary prevention of the chronic diseases cardiovascular disease, including coronary artery disease and stroke, cancer, chronic obstructive lung disease and diabetes?

METHODS

Searching the Literature

The literature search strategy is detailed in Appendix 1. In summary, electronic databases were searched for the period of January 1990 to December 2006. Government agency websites of countries with workplace practices and standards similar to those in Ontario were searched to locate grey literature. Key journals were hand-searched from January 2000. References of articles were checked and the works of predominant authors searched. The Working Committee provided references and contacted known experts.

The original literature search included workplace interventions that dealt with nutrition, physical activity and smoking cessation, and combinations of the aforementioned. As stated previously, poor nutrition, physical inactivity and tobacco use have been recognized as the leading social/behavioural risk factors for these chronic diseases in Canada (Chronic Disease Prevention Alliance of Canada, 2007). The authors felt that interventions addressing all three risk factors would be most beneficial. To be considered, interventions had to combine two or more programs in nutrition, physical activity, or smoking cessation. It is hoped that with further funding systematic reviews of single-factor interventions to reduce chronic disease in the workplace and a subsequent review of these reviews to determine what interventions are most effective can be completed.

Relevance

To be included, studies had to meet all of the following criteria (see Relevance Tool, Appendix 2):

- report on a primary prevention intervention relevant to public health/health promotion in Canada. Programs implementing pharmaceutical interventions would not be considered relevant
- report on an intervention targeted at changing behaviour (education, skill building, and supportive environment) in the workplace related to two or more of:
 - diet/nutrition
 - physical activity

- smoking cessation (except government legislation or environmental or policy interventions for banning smoking in the workplaces)
- report on a randomized controlled trial
- implement the intervention in a population of working adults. Programs directed only to adults at high risk (people with diabetes or hypertension) are not included
- take place in a country with workplace practices and standards similar to those in Ontario: Canada, the United States, Australia, New Zealand, or Northwestern Europe (United Kingdom, Ireland, Norway, Sweden, Denmark, France, Belgium, Netherlands, Germany, Switzerland, Austria)
- report on a change in chronic disease rates, reduction in intermediate outcome biomarkers (body mass index (BMI), weight, % body fat, blood pressure (BP), cholesterol, lipids, triglycerides), or behaviour that effects these biomarkers (improvement in nutrition, physical activity, smoking cessation rates, or environmental changes to encourage healthy eating, increased physical activity or smoking cessation). Changes in knowledge or attitude are not included because although they may be necessary for behaviour change, they have not conclusively shown to impact behaviour change (Atkinson & Nitzke, 2001; Proper, Koning, van der Beek, Hildebrandt, Bosscher & van Mechelen, 2003).

The results of the literature searches were captured and downloaded. Two reviewers independently screened all titles and abstracts for potential relevance. The full article was then obtained for all potentially relevant articles and independently rated for relevance by two reviewers. Differences were resolved through consensus.

Quality Assessment

Relevant studies were assessed for methodological quality. Following the guidelines set out by Mulrow, Cook, & Davidoff, 1997 and Jadad et al., 1996, a tool to assess the methodological quality of primary studies developed and tested by the Effective Public Health Practice Project (Thomas, Ciliska, Dobbins, & Micucci, 2004) was used. The tool consists of six criteria: selection bias, allocation bias, control of confounders, blinding of outcome assessors, data collection methods and withdrawals and dropouts. The quality assessment tool is presented in Appendix 3. An accompanying dictionary is available from the Effective Public Health Practice Project. Two reviewers independently rated each article for methodological quality. According to a predetermined scale outlined in the dictionary, all criteria were rated as strong, moderate or weak. The article was then assessed for overall strength based on the rating of each criterion. Discrepancies in quality assessment ratings were resolved by consensus or a third reviewer.

Data Extraction

Data were extracted from all relevant studies. A standardized extraction form was used to gather information about the target population, intervention and outcomes. As well, the theoretical framework upon which the interventions were based was collected

to determine whether a framework had an impact on the effectiveness of interventions and which framework(s) showed the most promise. All statistically significant and non-significant outcomes that were considered to be relevant were reported.

Synthesis/Analysis of Data

If appropriate a meta-analysis will be considered. If the populations, interventions or outcome measures prove to be too diverse a narrative synthesis will be performed. The decision and related outcome rational will be explored in detail at a further point in the review.

RESULTS

Interventions are referred to by their project or study name and are listed under Included Studies in the references. Eleven multi-faceted studies and two sub-studies were found to be relevant. Two sub-studies (WellWorks, Working Healthy) were embedded in a larger study (Working Well Trial) and will be reported as separate studies because each added an additional component to the main intervention. One study (PHLAME) compared two intervention groups to a control group and will be reported separately where appropriate. Investigators in several intervention studies had written more than one paper about the intervention. All available papers were reviewed and the overall results are presented as a project account. In total there are seven project accounts (PACE, Take Heart, WellWorks, WellWorks-2, Healthy Directions, Healthy Worker, and Working Well). Where possible, studies are referred to by the name of their program. Three studies looked at interventions combining nutrition and physical activity (CHIP, PACE, PHLAME), two studies focused on nutrition and smoking cessation (Take Heart, WellWorks-2) and eight studies combined nutrition, physical activity and smoking cessation (Gomel, Oldenburg & Simpson, 1993, Healthy Directions, Healthy Worker, Healthy Works, Nisbeth, Klausen, & Andersen, 1999, Working Well, WellWorks, Working Healthy). Details of the studies can be found in Table 1. Preliminary work was found for two additional studies. Authors reported that there are no plans to publish the results of a study on small workplaces in South Wales (Fine, Ward, Burr, Tudor-Smith, 2004). We look forward to when the results of the largest workplace intervention trial in Australia, the National Workplace Health Project, are published (Simpson et al., 2000).

Quality Assessment

All studies rated weak overall for methodological quality (Table 2). The overall score of **weak** resulted when one or more criterion was rated weak. Selection Bias was rated strong in one study (Gomel et al., 1993), moderate in three studies (Take Heart, Working Well, Working Healthy) and weak in the remaining studies. All but one study (Gomel et al., 1993) took place with volunteer worksites and/or individuals. Of the worksites and individuals approached to participate 80-100 percent in the case of strong, 60-79 percent in the case of moderate and less than 60 percent in the case of weak ratings agreed to participate. Where the individual was the unit allocation participation rates ranged from five percent (CHIP) to 56 percent (Nisbeth et al., 1999). Participation rates varied widely in studies using the worksite as the unit of

allocation. In the largest trial (Working Well), four research centers carried out the same core intervention. Participation rates for each of the four study centers were 100, 70, 16 and 15 percent respectively.

Two studies used the individual as the unit of allocation (CHIP, Nisbeth et al., 1999), one study the business unit (PACE) and the remaining studies the worksite. Three studies using the worksite as the unit of allocation and the individual as the unit of analysis incorporated cluster analysis (WellWorks-2, Gomel et al., 1993, Working Healthy) while three studies did not take into account a group effect (PACE, PHLAME, Healthy Works). The remaining studies were consistent with the unit of allocation and analysis.

Two of the eleven studies reported the method of random allocation (CHIP, Nisbeth et al., 1999). Both were appropriate. Two studies reported randomization was performed by a biostatistician independent of the study team (PACE, WellWorks-2). One study reported the method of random allocation as concealed (PACE). All but one study (PHLAME) had no difference in groups for relevant confounders at baseline or handled the difference in their analysis.

The data in five (WellWorks-2, Working Well, WellWorks, Working Healthy, Nisbeth et al., 1999) of the thirteen studies was derived from self-reported measurement tools only. The remaining studies used a combination of biologic and self-reported measurement tools. In all but two studies (Healthy Directions, Take Heart for smoking) self-reported measurements tools were reliable and valid.

The rating of withdrawals and dropouts was also dependent on the unit of analysis. Withdrawals were less than eight percent in studies using the worksite as the unit of analysis. Loss to follow-up was less than 13 percent when the individual was the unit of allocation and analysis. Loss to follow-up was as much as 43 percent in studies with inconsistent allocation and analysis using cluster analysis and as much as 23 percent with inconsistent allocation and no cluster analysis. One study (Working Healthy) did not report the number of individuals at baseline.

Details of Studies

The 13 studies varied widely in populations. Studies were carried out in 1 (CHIP, PACE, Nisbeth et al., 1999), 3 (PHLAME), 9 (Healthy Works), 15 (WellWorks-2), 24 (WellWorks), 26 (Working Healthy, Healthy Directions), 27 (Take Heart), 28 (Gomel et al., 1993), 32 (Healthy Worker), and 114 (Working Well) workplaces. Worksites included a medical care insurance provider (CHIP), government services (PACE), fire station (PHLAME), heterogeneous worksites (Take Heart, Working Well, WellWorks, Working Healthy, Healthy Worker), mid-sized manufacturing worksites (WellWorks-2), ambulance station (Gomel et al., 1993), computer company (Nisbeth et al., 1999), small manufacturing worksites (Healthy Directions), and small to mid-sized light manufacturing worksites (Healthy Works). Studies included female, blue-collar workers only (Healthy Works), male, white-collar workers only (Nisbeth et al., 1999), diverse workplace populations (Take Heart), primarily male/female white-collar workers (Healthy Worker), female white-collar workers (CHIP), male white-collar workers (PACE), male blue-collar workers (WellWorks-2, Working Well, WellWorks,

Working Healthy, Healthy Directions) and firefighter/paramedics (PHLAME, Gomel et al., 1993).

Interventions were based on a theoretical framework in 11 studies. The most frequently cited theories used were the transtheoretical framework/stages of change (PACE, PHLAME, Take Heart, Gomel et al., 1993, Healthy Works), social cognitive/social learning theory (PHLAME, Working Well, WellWorks, Working Healthy, Healthy Works), behaviour change model (WellWorks-2, Working Well, WellWorks, Working Healthy), social network and support model (Working Well, WellWorks, Working Healthy, Healthy Works), and principles of employee participation (Working Well, WellWorks, Working Healthy, Healthy Directions). Other models used were a social context framework targeting multiple levels on influence of behaviours (Healthy Worker), ecological model of change (Healthy Works), activation and diffusion, action theories of motivation, principles of adult learning, reciprocal determinism, diffusion of innovation, mass communication, social marketing, community organizational approaches, public health/policy strategies (Working Well, WellWorks, Working Healthy). Although the transtheoretical/stages of change framework was used for five studies, change of stage was reported in only two studies (PACE, WellWorks). In one study (PACE) there was no change of stage of physical activity or nutrition for males or females. Stage of change significantly ($p=0.002$) relapsed in caloric intake and weight management. Of those who regressed 53 percent moved from action/maintenance to contemplation/preparation. The second study (WellWorks) randomized workplaces in a sub study of a larger study (Working Well) to remain with the nutrition and smoking cessation, or to nutrition, smoking cessation and physical activity. Both groups progressed in stages of change for physical activity and fat intake.

The 13 interventions incorporated a combination of 17 components (Table 3). Interventions incorporated 3 components (Healthy Worker, Healthy Works) to 7 components (Gomel et al., 1993). Intervention periods lasted 6 months (CHIP, PHLAME), 9 months (PACE), 12 months (Gomel et al., 1993, Nisbeth et al., 1999), 18 months (Healthy Directions, Healthy Works), 24 months (Take Heart, WellWorks-2, Healthy Worker, Working Well, WellWorks) and 30 months (Working Healthy). Twelve studies reported on outcomes upon the completion of the intervention and one study reported on outcomes at the completion and two years after the completion of the intervention (Working Well) (Table 4). The 13 studies reported on a combination of 22 individual-level outcomes and 13 organizational-level outcomes. Details of the studies can be found in Table 1.

Synthesis/Analysis of Data

Given the heterogeneity of the populations, the weak quality of the studies, and the multiple intervention components and outcome measures the data will be summarized in a narrative format (Deeks, Higgins, & Altman, 2006). The heterogeneity of the populations, interventions and outcome measures also make it difficult to compare studies. The most common elements the studies possessed were outcome measures. To ascertain what are the components and characteristics of successful workplace health interventions each outcome measure will be examined individually. Interventions that were effective in improving that outcome will be compared to

interventions that were not successful taking into account common intervention components and study populations.

OUTCOMES

Chronic Disease

No studies reported a chronic disease as an outcome measurement. All studies reported an intermediate outcome biomarker for chronic diseases or behaviours that affect these biomarkers.

Intermediate Outcome Biomarkers for Chronic Disease

Body Mass Index (BMI) – five studies, three nutrition and physical activity (CHIP, PACE, PHLAME,) and two nutrition, physical activity and smoking cessation (Gomel et al., 1993, Nisbeth et al., 1999) reported BMI as an outcome measure. Two studies showed a statistically significant decrease in BMI (CHIP, Nisbeth et al., 1999) and one study showed a statistically significant increase in BMI (Gomel et al., 1993). The studies that reported a decrease in BMI took place in primarily female (CHIP) and male (Nisbeth et al., 1999) white-collar workers. BMI increased in paramedics (Gomel et al., 1993) and did not change in male, white-collar (PACE) and male, firefighters/paramedics (PHLAME). A common component to the two interventions that showed a decrease in BMI was professional instruction, however the intervention that showed an increase in BMI also included professional instruction.

Weight – three studies, one nutrition and physical activity (PACE), two nutrition, physical activity and smoking (Nisbeth et al., 1999, Healthy Worker) reported on weight. All studies showed a statistically significant weight reduction. All interventions were conducted in workplaces of primarily male (PACE, Nisbeth et al., 1999) and male/female (Healthy Worker) white-collar workers. All interventions had professional instruction in common.

Percent Body Fat – three studies, two nutrition and physical activity (CHIP, PACE) and one nutrition, physical activity and smoking cessation (Gomel et al., 1993) reported on percent body fat. Two (CHIP, PACE) of the three studies reported a statistically significant reduction in percent body fat. The studies that reported a decrease in percent body fat took place in female (CHIP) and male (PACE) white-collar workers. The intervention that was not effective took place in a workplace of primarily male paramedics (Gomel et al., 1993). The effective interventions had professional instruction and distribution of educational materials in common as did the ineffective intervention.

Diastolic/Systolic Blood Pressure (BP) – three studies, two nutrition and physical activity (CHIP, PACE) and one nutrition, physical activity and smoking cessation (Nisbeth et al., 1999) reported BP as an outcome. No studies reported a decrease in BP.

Cholesterol – five studies, two nutrition and physical activity (CHIP, PACE), one nutrition and smoking cessation (Take Heart) and two nutrition, physical and smoking cessation studies (Gomel et al., 1993, Nisbeth et al., 1999) reported on cholesterol. Three studies (CHIP, PACE, Gomel et al., 1993) reported a statistically significant reduction in cholesterol. The effective interventions took place in workplaces of primarily female (CHIP) and male (PACE) white-collar workers and male paramedics (Gomel et al., 1993). Cholesterol did not decrease in workplaces of primarily male, diverse occupations (Take Heart) and male only, white-collar workers (Nisbeth et al., 1999). The effective interventions had professional instruction and distribution of educational materials in common, however the ineffective intervention (Nisbeth et al., 1999) also included professional instruction.

High Density Lipoproteins (HDL) – three studies, one nutrition and physical activity (CHIP), one nutrition and smoking cessation (Take Heart) and one nutrition, physical activity and smoking cessation (Nisbeth et al., 1999) reported on HDL. One study (CHIP) reported a statistically significant reduction in HDL. The effective intervention took place in a workplace of primarily female, white-collar workers (CHIP). HDL was not reduced in workplaces of primarily male, diverse (Take Heart) and male only, white-collar occupations (Nisbeth et al., 1999). The effective intervention included group education/counselling, distribution of educational materials, activities, and financial incentives which were not included in the intervention that failed to reduce HDL.

Low Density Lipoproteins (LDL) - three studies, two nutrition and physical activity (PACE, PHLAME) and one nutrition, physical activity and smoking cessation (Nisbeth et al., 1999) reported on LDL. Two studies (PACE, PHLAME) reported a statistically significant reduction in LDL. The effective interventions took place in workplaces of primarily male, white-collar workers (PACE) and male firefighters (PHLAME). LDL was not reduced in a workplace of male only, white-collar workers (Nisbeth et al., 1999). Both effective interventions included the distribution of educational materials which was not a component in the intervention that did not report a reduction in LDL.

Triglycerides - two studies, one nutrition and physical activity (PACE) and one nutrition, physical activity and smoking cessation (Nisbeth et al., 1999) reported on triglycerides. Neither intervention was effective at lowering triglyceride levels.

Behaviours that Effect Intermediate Outcome Biomarkers

Nutrition:

Fruit & Vegetable Consumption – seven studies, two nutrition and physical activity (CHIP, PHLAME), two nutrition and smoking cessation (Take Heart, WellWorks-2), and three nutrition, physical activity and smoking cessation studies (Working Well, Healthy Directions, Healthy Works) reported on fruit and vegetable consumption. Three studies (CHIP, Working Well, Healthy Works) reported a statistically significant increase in fruit and vegetable consumption. The interventions were successful in workplaces of primarily female white-collar (CHIP), female only blue-collar (Healthy Works) and male blue-collar workers (Working Well). Fruit and vegetable consumption did not increase in workplaces of male firefighters (PHLAME), diverse occupations

(Take Heart) and blue-collar workers (WellWorks-2, Healthy Directions). There were no common components in the effective interventions.

Fibre Consumption – three studies (Working Well, WellWorks, Working Healthy), all nutrition, physical activity and smoking cessation studies reported on fibre consumption. All studies implemented the same core intervention. Only the sub-study, that added physical activity to the core intervention (Working Healthy), reported a statistically significant increase in fibre consumption. The three studies were carried out in primarily male, blue-collar workers.

Fat Consumption – six studies, two nutrition and physical activity (CHIP, PHLAME), one nutrition and smoking cessation (Take Heart), and three nutrition, physical activity and smoking cessation studies (Working Well, WellWorks, Healthy Works) reported on fat consumption. Three studies (CHIP, Working Well, WellWorks) and an arm of one study (PHLAME individual-based) reported a statistically significant decrease in fat consumption. The interventions were successful in populations of female white-collar (CHIP), male blue-collar workers (Working Well, WellWorks) and male firefighters (PHLAME individual-based). The interventions were not successful at reducing fat consumption in male firefighters (PHLAME team-based), male diverse occupations (Take Heart) and female only blue-collar workers (Healthy Works). Planned activities and the distribution of educational material were common to all the effective interventions and in one of the three ineffective studies.

Grain Consumption – one study reported on grain consumption (CHIP) as an outcome. The intervention was not effective at increasing grain consumption.

Meat Consumption - two studies, one nutrition and physical activity (CHIP), and one nutrition, physical activity and smoking cessation studies (Healthy Directions) reported on meat consumption. One study (CHIP) reported a statistically significant decrease in meat consumption. The effective study (CHIP) was carried out in a workplace of primarily female, white-collar workers and the ineffective intervention in a workplace of primarily male, blue-collar workers. Professional instruction, distribution of educational materials, activities, and financial incentives were incorporated in the effective intervention and not in the ineffective intervention.

Sodium Consumption – one study on nutrition and physical activity (CHIP) reported on sodium consumption. The study found a statistically significant decrease in sodium consumption. The intervention was carried out in a workplace of primarily female, white-collar workers and incorporated professional instruction, group education/counselling, distribution of educational materials, activities, and financial incentives.

Physical Activity:

Physical Activity/Exercise -six studies, three nutrition and physical activity (CHIP, PACE, PHLAME), and three nutrition, physical activity and smoking cessation studies (Working Healthy, Healthy Directions, Healthy Works) reported on physical activity/exercise. Three studies (CHIP, PACE, Working Healthy) and one arm of one study (PHLAME team-based) reported a statistically significant increase in physical

activity/exercise. The effective studies were carried out in workplaces of primarily female white-collar (CHIP), male white-collar (PACE, Working Healthy) and male firefighters (PHLAME team-based). The ineffective interventions were carried out in workplaces of primarily male firefighters (PHLAME), male blue-collar (Healthy Directions) and female only blue-collar workers (Healthy Works). The distribution of educational material was common to all the effective interventions but also to the arm of one study that was not effective (PHLAME team-based).

Maximum Oxygen Uptake (VO2 Max) - two studies, both nutrition and physical activity (PACE, PHLAME) reported on maximum oxygen uptake or aerobic power as an outcome. Neither intervention was effective at increasing maximum oxygen uptake.

Aerobic Capacity – two studies on nutrition, physical activity and smoking cessation (Gomel et al., 1993, Nisbeth et al., 1999) reported on aerobic capacity. One study found a statistically significant increase in aerobic capacity. The effective intervention was carried out in a workplace of primarily male paramedics (Gomel et al., 1993) and the ineffective intervention in male only, white-collar workers (Nisbeth et al., 1999). The effective intervention incorporated the distribution of educational materials, financial incentives and a plan formulated by professionals.

Heart Rate - two studies on nutrition and physical activity (CHIP, PACE) reported on heart rate. Both studies found a statistically significant decrease in heart rate. Both studies were carried out in populations of white-collar workers, one intervention in primarily female (CHIP) and the other in primarily male (PACE) workers. The two interventions shared two components, professional instruction and the distribution of educational material.

Smoking Cessation:

Smoking Cessation - nine studies and two sub-studies, one nutrition and smoking cessation (Take Heart) and the remaining nutrition, physical activity and smoking cessation (Working Well, WellWorks-2, Working Healthy, Gomel et al., 1993, Nisbeth et al., 1999, Healthy Directions, Healthy Worker, Healthy Works) reported on smoking cessation. No studies found a statistically significant increase in smoking cessation rates. In subgroup analyses one study (WellWorks-2) found that for hourly workers quit rates in the health promotion plus occupational health and safety group were more than double that of the health promotion group only.

Smoking Quit Attempts - three studies, two nutrition and smoking cessation (Take Heart, WellWorks-2) and one nutrition, physical activity and smoking cessation (Working Healthy) reported on smoking quit attempts. No studies found a statistically significant increase in smoking quit attempts.

Summary

Individual Outcomes:

Of the thirteen outcomes showing a statistically significant improvement, interventions incorporated the distribution of educational material for ten outcomes, professional instruction for seven outcomes, financial incentives for three outcomes, education/ counselling and planned activities for two outcomes and a personal plan formulated by a professional for one outcome. Studies reporting outcomes nine months or less from commencement (CHIP, PACE, PHLAME) were more successful than the remaining studies reporting outcomes twelve months or later. Studies with longer intervention periods or follow-up reporting outcomes over multiple time periods showed a return to baseline of most outcome measures (Working Well, Gomel et al., Health Works for Women).

Organizational-level Outcomes:

Although six studies (Take Heart, WellWorks-2, Working Well, WellWorks, Working Healthy, Healthy Directions) reported an environmental component to their intervention, only one study reported on organizational changes at the conclusion of their intervention (Working Well). The one trial (Working Well) found a statistically significant difference in the increase of nutritional labelling, healthier foods in vending machines, healthy food environment index, employees' perceptions of access to healthy food and nutrition information, and co-worker and employer support for healthier nutrition and smoking cessation. There were no differences between the intervention and control groups for reduced fat and increased fibre in food services or vending machines, catering policy, and employees' perceptions of the physical environment with respect to smoking. This study incorporated employee advisory boards to work with management to initiate environmental changes.

CONCLUSIONS

Implications for Research

There are many limitations to the studies included in this systematic review; therefore, there are limitations to this systematic review. The overall quality of the studies is weak specifically in the areas of Selection Bias, Blinding and Allocation Concealment. Participation rates varied greatly and were as low as 15 percent of worksites and 5 percent of individuals. All but one study occurred within volunteer worksites and individuals making the results open to a healthy volunteer effect whereby participants are generally healthier than non-participants (Pinsky, 2005, Hara, 2002, Thomson, 2005, Froom, 1999) so may not represent the general worksite population. Participation rates at the worksite level may improve if businesses were informed of the economic benefits of incorporating health promotion at the worksite (Proper et al., 2004, Chapman, 2005, Pelletier, 2005). This in turn may also influence businesses to offer more support that would increase participation at the individual level.

The lack of blinding of the investigators has been shown to reduce objectivity in interpreting outcomes. The lack of blinding of participants has been shown to decrease adherence to assigned treatment, increase the likelihood of group crossover and increase drop-out rates (Viera, 2007). To allow for blinding to take place, investigators should look to agencies that would carry on the program after the study, such as public health, to implement interventions. This would not only allow for blinding but would report on interventions as they would occur in the 'real world'.

A systematic review comparing RCTs that concealed random allocation to RCTs that failed to adequately conceal random allocation found an over estimation of effect size (Kunz and Oxman, 1998). Again, including agencies that would normally carry out health promotion interventions at the workplace would remove the investigators one step and facilitate allocation concealment.

The success of interventions reporting on the intermediate outcome biomarkers for chronic disease and behaviours that affect these biomarkers varied within intervention components, within interventions, and within populations. Outcomes reported should focus on biomarkers and behaviours that are shown to be affected by behaviour.

Studies that showed the greatest success were for the shortest intervention and follow-up periods. These results should be viewed with caution as studies with longer intervention periods or follow-up reporting outcomes over multiple time periods showed a return to baseline of most outcome measures (Working Well, Gomel et al., Health Works for Women). Cohort studies, that were not included in this review, should be referred to for validation of long term benefits.

Implications for Policy

The Chronic Disease Prevention Alliance of Canada states that there are no "magic bullets". That "effective interventions are those that are implemented with sufficient intensity, are comprehensive, well-coordinated, multilevel (i.e. community, provincial, national), and sustained over several years" (<http://www.cdpac.ca/>). The disappointing results of this review and others (Thomas, Ciliska, Micucci, Wilson-Abra & Dobbins, 2004, Micucci, Thomas & Vohra, 2002, Dobbins et al., 2001, Kuhn, Doucet & Edwards, 1999, Dobbins & Beyers, 1999) support this declaration. It is now up to government agencies to fund and researchers to carry out these interventions so that they can be put forward as evidence-based practice.

Implications for Programming and Practice

Many of the recommendations stated above call for the expertise and partnership of agencies such as public health to participate in research and programs. To participate, agencies must be sufficiently funded and staffed to supply these services to complex venues such as the workplace. They must acknowledge that there are different needs depending on the workforce, size, industrial classification, sector and geographical location of the workplace. They must also acknowledge that the workplace is constantly evolving with many changes to the traditional definition of work and where it is performed. This commitment cannot be taken lightly as for the number of workplaces that exist.

Conclusions

In general, at the individual level, interventions that incorporated the distribution of educational material and professional instruction were more successful than interventions that did not. Longer follow-up periods are necessary to determine if these components are successful in the long-term. At the workplace level, one study reported on outcomes at the organizational level. There is insufficient evidence to recommend or not recommend multi-faceted strategies at the organizational level for the primary prevention of chronic disease.

TABLES

Table 1: Table of Included Studies

Table 2: Quality Assessment Rating of Included Studies

Table 3: Intervention Strategies of Included Studies

Table 4: Reported Outcomes of Included Studies

TABLE 1

TABLE OF INCLUDED STUDIES (n=13)

Nutrition & Physical Activity				
	Participants	Intervention	Outcomes & Results	Additional Comments
CHIP 2005 United States	Employees of a large medical care provider (n=137), primarily female (86%), white (96%), married (75%), family income > \$60000 (54%), > high school education (80%)	<p>Coronary Health Improvement Project (CHIP) to improve cognitive understanding of the importance of lifestyles, nutrition, physical activity and chronic disease risk factors.</p> <ul style="list-style-type: none"> live instruction (on medicine, diet, chronic disease risks, behavioural change, self-worth) 2 hours 4 x week x 4 weeks health professionals as guest speakers shopping tours and cooking demonstrations a text book and workbooks with assignments following discussion topics after-program support spouses encouraged to participate financial incentives <p>Control group</p> <p>Theoretical framework: none mentioned</p>	<p>Difference between the Intervention and Control groups at 6 months</p> <p>Cardiovascular Risk Factors p<0.05 ↓ BMI, weight, % body fat, resting heart rate, cholesterol, HDL</p> <p>NS ↓ systolic BP, diastolic BP, glucose, triglycerides, high-sensitivity C-reactive protein</p> <p>Physical Activity & Nutrition Variables p<0.05 ↑ total steps per week, % carbohydrates, fruit and vegetable fibre, vegetable servings, fruit servings,</p> <p>p<0.05 ↓ total energy % calories from fat, % calories from protein, meat servings, total dietary fat, dietary cholesterol, polyunsaturated fat, monounsaturated fat, saturated fat and sodium</p> <p>NS ↑ whole grain servings</p>	<p>Highly intensive program</p> <p>In spite of intense recruitment strategies only 180 of 2,744 volunteered to participate</p> <p>Effectiveness decreased from 6 weeks to 6 months. Longer follow-up period is needed.</p>

	Participants	Intervention	Outcomes & Results	Additional Comments
PACE 2003 Netherlands	Employees (n=299) municipal, white-collar, work >24 hours/week, male (), 49 years of age, highly educated (63%)	Intervention Patient Centered Assessment & Counselling for Exercise & Nutrition Program (PACE) <ul style="list-style-type: none"> personalized feedback from a sports physician and physiotherapist a maximum of 7 x 20-minute consultations with a physiotherapist offered during work time plan to improve concerned behaviour formulated written information about lifestyle factors Control <ul style="list-style-type: none"> written information about lifestyle factors Theoretical framework: Transtheoretical Model	Difference between PACE and Control groups at 9 months p<0.001 ↓ sub maximal HR p<0.003* ↑ energy expenditure p<0.004* ↑ sport index p<0.015 ↓ body fat % p<0.040 ↓ cholesterol NS leisure-time index, BMI, diastolic BP, systolic BP *effect due to decrease in control group not increase in PACE group	The worse the baseline health profile the more positive the effects of the intervention The intervention was started in the spring and outcomes were measured in the winter when there has been shown a natural decrease in physical activity

	Participants	Intervention	Outcomes & Results	Additional Comments																					
PHLAME 2004 United States	Firefighters in 3 comparable fire stations (n=33)	<p>Team-based curriculum (TBC) with each shift forming a team</p> <ul style="list-style-type: none"> • Firefighters' Health and Fitness Guide • assessment and feedback of personal potentially influential factors, dietary habits and physiological measures • squad leader designed and provided with orientation and guide • 10 weekly 45 minute peer-taught sessions • collaboration on formulating and meeting objectives • social disclosure of behaviours in reaching nutrition and physical activity goals <p>Individualized-based Curriculum (IBC)</p> <ul style="list-style-type: none"> • Firefighters' Health and Fitness Guide • assessment and feedback of personal potentially influential factors, dietary habits and physiological measures <p>4 x 60 minute sessions with a trained health counsellor plus additional phone or in-person contacts</p>	<p>Difference between TBC and IBC compared to Control at 6 months</p> <table> <thead> <tr> <th></th> <th>TBC</th> <th>IBC</th> </tr> </thead> <tbody> <tr> <td>↓ LDL cholest</td> <td>p=0.031</td> <td>p=0.013</td> </tr> <tr> <td>↓ dietary fat</td> <td>NS</td> <td>p=0.008</td> </tr> <tr> <td>↑ exercise</td> <td>p=0.08</td> <td>NS</td> </tr> <tr> <td>↑ fruit & veg</td> <td>NS</td> <td>NS</td> </tr> <tr> <td>↑ BMI</td> <td>NS</td> <td>NS</td> </tr> <tr> <td>↑ max oxygen</td> <td>NS</td> <td>NS</td> </tr> </tbody> </table>		TBC	IBC	↓ LDL cholest	p=0.031	p=0.013	↓ dietary fat	NS	p=0.008	↑ exercise	p=0.08	NS	↑ fruit & veg	NS	NS	↑ BMI	NS	NS	↑ max oxygen	NS	NS	Not the usual workplace. Firefighters worked 24 hours then off for 48 hours.
	TBC	IBC																							
↓ LDL cholest	p=0.031	p=0.013																							
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↑ fruit & veg	NS	NS																							
↑ BMI	NS	NS																							
↑ max oxygen	NS	NS																							

	Participants	Intervention	Outcomes & Results	Additional Comments
		<ul style="list-style-type: none"> • sessions based on individual's place in change process • 1 x 15 minute meeting with a physician <p>Test plus results only</p> <ul style="list-style-type: none"> • assessment and feedback of personal potentially influential factors, dietary habits and physiological measures <p>Theoretical framework: Team-based: social learning theory</p> <p>Individual-based: Transtheoretical Model</p>		

Nutrition and Smoking Cessation				
	Participants	Intervention	Outcomes & Results	Additional Comments
TAKE HEART United States 1995	Worksites employing between 125 and 750 employees (n=27), mean # employees = 247, privately held (n=14), public sector (n=12), unionized (n=17)	<p>Take Heart Program -</p> <ul style="list-style-type: none"> • assessment and feedback of employee health habits, job characteristics, cholesterol assessment and diet at baseline and 2 years • Workplace Steering Committees (WSC) formed • WSCs provided assistance from research staff and written guidelines • WSCs met monthly to select and publicize activities and events and lobby for health promotion policies • activities in tobacco and food choices were based on motivational/ incentive, educational/ skills, policy/environment and maintenance activities • WSCs were expected to choose at least 2 activities • environmental changes including tobacco-use policies and low fat items in cafeterias and vending machines initiated • activities were coordinated with community and national events 	<p>Difference between Take Heart Program and Delayed Intervention at 2-years</p> <p>NS smoking prevalence, smoking cessation, fat intake, smoking quit attempts, total cholesterol % employees with total cholesterol >200, % calories from fat</p>	<p>Low cost, low intensity program</p> <p>There was considerable variability across worksites within all diseases. For example, smoking cessation rates varied between 17 to 65%. Authors recommended that interventions be tailored to the worksite.</p> <p>Although Workplace Steering Committee activities were fully supported by the employer there were large differences in their levels of activity</p>

	Participants	Intervention	Outcomes & Results	Additional Comments
	The Delayed Intervention Group (DIG) from Take Heart 1 and newly recruited matched worksites	<p>Delayed Intervention Group</p> <ul style="list-style-type: none"> assessments and feedback of employee health habits, job characteristics, cholesterol assessment and diet at baseline and 2 years <p>Theoretical framework: Transtheoretical Model</p> <p>Take Heart I Program plus greater direction and support to steering committees and program to promote physical activity</p> <p>Theoretical framework: Transtheoretical Model</p>	<p>Change between DIG and Control at 19 months</p> <p>p<0.04 fat intake p<0.03 smoking quit attempts</p> <p>NS smoking prevalence, smoking cessation, Kristal food habits, limit fat in diet, total cholesterol, % employees with total cholesterol >200 mg/dl, HDL cholesterol, CHD risk score</p>	The DIG Workplace Steering Committees were offered greater support than the Take Heart 1 Workplace Steering Committees

	Participants	Intervention	Outcomes & Results	Additional Comments
WELLWORKS-2 2003 United States	<p>Manufacturing worksites (n=15) using chemical hazards, employing between 400-2,000 workers, turnover rate <20%</p> <p>Respondents (n=5,156) were employed on a permanent basis and worked onsite ≥ 15 hours per week</p>	<p>Worksite health promotion with an occupational health and safety intervention focusing on the worksite organization, environment and individual (HP/OHS)</p> <ul style="list-style-type: none"> • Employee Advisory Boards (EAB) consisting of workers, management and health and safety representation formed • EABs consulted to management on tobacco control policies, food catering and catering policies and reduce exposure to hazardous substances inherent in the work processes • one-to-one consultation and technical assistance, group educational sessions, written materials • individual interventions focusing on nutrition, tobacco use and occupational health and safety <p>Worksite health promotion (HP) intervention</p> <ul style="list-style-type: none"> • EABs consisting of workers and management representation consulting to management on tobacco control policies, food catering 	<p>Difference between HP/OHS and HP at 2 years</p> <p>P<0.05 smoking quit rate in blue-collar (hourly workers) only</p> <p>NS smoking prevalence, overall smoking quit rate, fruit and vegetable servings, perceived hazardous exposure</p>	<p>Primary focus on blue-collar workers</p> <p>Smoking quit rates for blue collar workers in the intervention incorporating occupational health and safety were double that of the intervention not incorporating occupational health and safety</p> <p>Blue-collar workers may perceive greater health risks from the job hazards than tobacco. Job hazards are tangible and immediate</p> <p>Health promotion interventions that include occupational health and safety may be able to capitalize on a significant motivator for change</p> <p>The connection between occupational health and safety does not appear to be as strong</p>

	Participants	Intervention	Outcomes & Results	Additional Comments
		<p>and catering policies</p> <ul style="list-style-type: none"> • individual interventions focusing on nutrition and tobacco <p>Theoretical frameworks: Corporate intervention: participatory model based on the principles of community organization and socio-ecological model</p> <p>Individual intervention: health communications and behaviour change</p>		

Nutrition, Physical Activity and Smoking Cessation				
	Participants	Intervention	Outcomes & Results	Additional Comments
Gomel et al., 1993 Australia	<p>Fire stations employing ≥ 12 employees (n=28)</p> <p>Participants (n=85) were primarily male (>80%), mean age 32 years, educated (80% \geq high school), living with someone (>55%), ambulance officer/ paramedic (>89%)</p>	<p>Health Risk Assessment (HRA) – assessment and feedback of each participants risk factor profile</p> <p>Risk Factor Education (RFE) – same as HRA plus general advice on lifestyle changes to CVD risk factors</p> <p>Behavioural Counselling (BC) – same as RFE plus counselling sessions from a psychologist, a self-instructional life-style change manual for modifying CVD risk factors based on stages of change model</p> <p>Behavioural Counselling plus Incentives (BCI) – RFE plus life-style change manual, goal-setting and follow-up counselling sessions and a range of incentives</p> <p>Theoretical Framework: Transtheoretical Model</p>	<p>Difference between behavioural interventions (BC & BCI) and non-behavioural interventions (HRA & RFE) at 12 months</p> <p>p<0.05 continuous smoking cessation</p> <p>p<0.04 *BMI</p> <p>NS % body fat, aerobic capacity, serum cholesterol, smoking cessation</p> <p>*BMI significantly increased in all groups but increased less in BC & BCI</p>	<p>Intensive recruitment strategies were used to accomplish an initial participation rate of 88% which is much higher than most published studies. The inclusion of less-motivated participants may have reduced the efficacy of the strategies but made the results more generalized to the workplace population</p> <p>% body fat, mean blood pressure, smoking and aerobic capacity improved early in the study but returned to baseline rates at 12 months demonstrating the need for follow-up periods last at least 12 months</p>

	Participants	Intervention	Outcomes & Results	Additional Comments
HEALTHY DIRECTIONS SMALL BUSINESS STUDY 2005 United States	<p>Manufacturing worksites, between 50 and 150 employees (n=26), multi-ethnic workplace (>25% first- or second- generation immigrants or people of color), turnover rate <20% in past year, power to decide on participation</p> <p>Employees (n=974) permanent, working ≥ 20 hours/week on-site, able to complete survey interview in English, Spanish, Portuguese or Vietnamese</p> <p>Respondents were primarily male (67%), non-Hispanic White (70%), participant or parent not born in United States (58%), mean age 43 years, > 4 yrs college (79%), ≥ 185% poverty level (84%), workers (85%)</p>	<p>Intervention targeted at the worksite</p> <ul style="list-style-type: none"> joint worker/manager participation in planning and delivery interventions designed to consider social context on and off the job opportunities for one-to-one interaction, small-group discussions, worksite-wide events targeting risk factors smoking cessation program organizational policy changes including healthful food options, physical activity facilities, smoke free worksite and extensive consultation on proactive, systems-oriented approaches to improving occupational health <p>Minimal-intervention</p> <ul style="list-style-type: none"> smoking cessation program <p>Theoretical framework: principles of employee participation, a social-context framework targeting multiple levels of influence on behaviours</p>	<p>Difference between Intervention and Minimal Intervention at 18-months</p> <p>NS fruit and vegetable consumption, red meat consumption, physical activity, smoking cessation</p> <p>Difference between Intervention and Minimal Intervention at 18-months by occupational status (workers and managers)</p> <p>p=0.048 ↑ fruit & veg for workers</p> <p>p=0.09 ↑ physical activity for workers</p> <p>Difference between Intervention and Minimal Intervention at 18-months by education status</p> <p>p=0.02 ↓ servings of red meat with increased education</p>	<p>Interventions addressed multiple cultures and low literacy rates</p> <p>Diverse cultural groups were represented in joint workers/management committees</p> <p>Materials translated into multiple languages</p> <p>The intervention was just as effective for Blacks, Asians and Hispanics as non-Hispanic Whites and for immigrants and first-generation Americans as with persons whose parents were born in the united States</p>

	Participants	Intervention	Outcomes & Results	Additional Comments
HEALTHY WORKER PROJECT 1993 United States	Worksites employing between 400-900 employees (n=32) primarily private sector (62%), professional or managerial job titles (40%, <20% blue collar workers), average age 38 years, education beyond high school (79%), slightly more than half women and majority	<p>Healthy Worker Project (HWP)</p> <ul style="list-style-type: none"> • 11 behaviour change classes led by a professional educator at 2-week intervals • state-of-the-art classes for weight reduction and smoking cessation • classes repeated on 4 occasions over 2 years • employees required to have an amount of money deducted from their pay check which was reimbursed when goal was met <p>Control – no intervention</p>	<p>Difference between HWP and Control at 2 years</p> <p>p=0.08 smoking cessation NS weight reduction</p> <p>Smokers only p<0.002 reduction in sick days</p>	<p>72% of eligible worksites declined to participate in an opportunity to receive a free weight loss and smoking cessation program suggesting the receptiveness of employers to worksite health promotion may modest at best</p> <p>Of participating worksites 12% smokers and 36% of obese employees participated. Participation dropped to about a third after the first round</p> <p>Higher participation was associated with smoking cessation (p=0.08) and greater weight loss (p<0.03)</p>

	Participants	Intervention	Outcomes & Results	Additional Comments
HEALTHY WORKS FOR WOMEN 2002 United States	Female employees in manufacturing worksites employing between 125-350 workers (n=9), all blue collar workers, English or Spanish speaking, primarily African American (58%), <40 years old (53%, married (66%), high school education (58%)	<p>Intervention</p> <ul style="list-style-type: none"> • computer tailored “women’s magazines providing personalized feedback, strategies for change and resource information • ‘natural helpers’ elected from each workplace to organize activities, diffuse information and support • ‘natural helpers’ educated in nutrition, physical fitness, stress management, cancer, weight management • designed to occur outside of work hours <p>Delayed intervention</p> <p>Theoretical frameworks: Conceptual Model: Ecological Model of Change</p> <p>Intervention: Social Cognitive Theory, stages of change transtheoretical framework, social support models</p>	<p>Differences between Intervention and Delayed Intervention at 18-months</p> <p>Nutrition</p> <p>6 18 months</p> <p>NS p=0.01 ↑fruit & veg</p> <p>NS p=0.02 ↑fruit</p> <p>NS p=0.03 ↑veg</p> <p>p=0.01 NS ↓fat intake</p> <p>Exercise</p> <p>NS p=0.004 ↑flexibility</p> <p>p=0.04 NS ↑strengthening activities</p> <p>p=0.08 NS ↑weights</p> <p>NS NS any exercise, aerobic activities, other exercises, METs</p> <p>Smoking</p> <p>NS NS ↓smoking</p>	<p>Smoking cessation training offered but declined at all worksites</p> <p>Women may not choose quitting smoking as a priority rather they preferred to focus on healthy eating and exercise</p>

	Participants	Intervention	Outcomes & Results	Additional Comments
Nisbeth et al., 1999 Denmark	Employees of a computer company, volunteers, male, white-collar employees, 25-45 years of age (n=74)	<p>Exercise and dietary counselling by an exercise psychologist to change at risk behaviours only based on the results of a baseline questionnaire and clinical examination</p> <ul style="list-style-type: none"> • exercise program (n=29) • smoking program (n=16) • diet program (n=11) • exercise & diet (n=6) • exercise & smoking (n=5) • exercise, diet & smoking (n=1) • no need for change (n=8) • no motivation (n=6) <p>Control group – no intervention</p>	<p>Change between Intervention (all programs) and Control at 1 year</p> <p>p<0.05 ↓ body weight, ↓ BMI, ↑ aerobic power</p> <p>NS total cholesterol, HDL, LDL, triglycerides, LDL/HDL ratio, systolic and diastolic BP, smoking cessation</p> <p>Changes between Intervention and program subgroup and Control at 1 year.</p> <p>Exercise program and Control NS all outcome measures</p> <p>Diet program and Control (outcome measures not reported were NS) p<0.05 ↓ body weight, ↓ total cholesterol, ↓ total cholesterol, ↓ LDL, ↓ triglycerides, ↓ LDL/ HDL ratio</p> <p>No Need to Control NS all outcome measures</p> <p>No Motivation to Control NS all outcome measures</p>	<p>Employees were only enrolled in programs in the risk factor they had. When only participants in the subgroup were reported just the participants in the diet program showed an improvement over the Control group</p> <p>Although the diet program participants were the only subgroup to show a difference adherence was poor compared to the other programs (physical activity program (76%) diet program (18%))</p>

	Participants	Intervention	Outcomes & Results	Additional Comments
<p>WORKING WELL TRIAL</p> <p>1999</p> <p>United States</p>	<p>Work sites (n=114) in 16 states representing manufacturing, communication, public service and utilities, ranging in size from 32 to 1,790 workers</p> <p>Respondents (n=20,801) were predominantly blue-collar (54%), male (70%), White (92%), and 50% had 12 years of education</p>	<p>Worksite health promotion (WWT) out of 4 study centres</p> <p>- Core intervention consisting of</p> <ul style="list-style-type: none"> Employee advisory boards formed to incorporate employee input and a work-site coordinators appointed <p>Organization level</p> <ul style="list-style-type: none"> consultation on smoking policy implementation and changes in food offerings in cafeterias, vending machines and catering <p>Individual level</p> <ul style="list-style-type: none"> kick-off event, interactive activities, self-assessment, self-help and educational materials, campaigns, contests and direct education <p>Control</p> <p>Summary of employee baseline survey results for distribution and 3 of 4 study centres provided an optional minimal intervention consisting of printed materials and/or self-help programs</p>	<p>Difference between WWT and Control after completion of intervention (1991-1993)</p> <p>Organization level</p> <p>Informants' reports</p> <p>p<0.0001 nutritional labelling</p> <p>p<0.001 vending-machine change</p> <p>NS reduced fat and increased fibre in food services or vending machines, catering policy changes</p> <p>Healthy Food Environment Index</p> <p>P<0.01 healthful changes</p> <p>Employee perception of</p> <p>p< 0.001 physical environment – access to healthy food, nutrition information</p> <p>NS smoking</p> <p>p< 0.001 social environment - co-worker support for low-fat diet and management concern about employees' nutrition</p> <p>p<0.05 co-worker and employer support to stop smoking</p>	<p>Largest published, English language trial on cancer control/nutrition and smoking interventions in the workplace.</p> <p>Broad range of work sites.</p> <p>The intervention consisted of environmental and individual programs.</p>

	Participants	Intervention	Outcomes & Results	Additional Comments
		<p>Theoretical Framework: Conceptual Overview: theories of behaviour change in the individual, organizational and community activation and diffusion theories</p> <p>Participatory Strategies: community activation theory</p> <p>Individual Level: social cognitive, social network and social support theories, action theories of motivation, principles of adult learning</p> <p>Organizational Level: reciprocal determinism, diffusion of innovation, mass communication, social marketing, community organizational approaches, public health/policy change strategies</p>	<p>Individual level p=0.033 % energy from fat consumption p=0.0001 ↑ fruit & vegetables NS ↑ fibre densities NS change in tobacco use</p> <hr/> <p>2-years after completion of WWT intervention (1991-1995) WWT to control</p> <p>NS nutrition activities</p>	<p>The adoption of healthful diets was statistically more successful in interactive activities that last for longer periods of time (contests and classes) than one-time activities (kick-off events) or passive efforts (printed materials)</p> <hr/> <p>Institutionalization (the intervention became an integral part of the worksite) was the strongest predictor of the nutrition activities score at 2-years follow-up (p<0.0001)</p> <p>More emphasis should be put on institutionalizing a cancer prevention program to ensure sustainability. Embedding the program into existing organizational structures may prove more successful than creating new groups</p>

	Participants	Intervention	Outcomes & Results	Additional Comments
<p>WELLWORKS PROJECT</p> <p>Working Well Trial + occupational exposure</p> <p>1998</p> <p>United States</p>	<p>Worksites in the Intervention arm in 1 of the 4 research centres (n=24) primarily manufacturing, crafts persons or labourers (33%, professionals or managers 4%), male (70%), White (96%), <high school education (34%), Individuals (n=2386)</p>	<p>WellWorks Study (WWS) WWT plus</p> <ul style="list-style-type: none"> assessment of occupational exposures and recommendations to EAB on reducing occupational exposures on an organization level tailored activities and education material to reduce occupational exposure on an individual level <p>Control</p> <p>Summary of employee baseline survey results for distribution and 3 of 4 study centres provided an optional minimal intervention consisting of printed materials and/or self-help programs</p> <p>Theoretical framework: same as Working Well Trial</p>	<p>WWS to Control</p> <p>p<0.05 % energy from fat consumption,</p> <p>p<0.05 ↑ fruit & vegetables</p> <p>NS smoking cessation</p>	<p>Integrating an occupational health component was related to increased participation in smoking control activities (28% crafts persons and 37% other compared to 15% in other studies) and nutrition education (40% crafts persons compared to 29% in other studies)</p>

	Participants	Intervention	Outcomes & Results	Additional Comments
<p>WORKING HEALTHY PROJECT</p> <p>Working Well Trial + physical activity</p> <p>1999</p> <p>United States</p>	<p>Manufacturing worksites in the Intervention arm in 1 of the 4 research centres of the Working Well Trial (n=26)</p>	<p>Working Well Trial intervention plus</p> <ul style="list-style-type: none"> organizational level intervention expanded to include assessment of current physical activity options, presentation of assessment and discussion on methods to support physical activity with EAB individual level intervention expanded to include physical activity in activities, education and materials <p>Minimal Standard Care (MSC) – companies offered self-help programs for smoking cessation, nutrition and physical activity</p> <p>Theoretical framework: same as Working Well Trial</p>	<p>After completion of intervention in cohort that completed all surveys (n=2,055) at 2 ½ years WHP to MSC</p> <p>Final surveys</p> <p>p<0.03 ↑ physical activity</p> <p>p<0.06 ↑ fruit & vegetables</p> <p>p=0.001 ↑ fibre consumption</p> <p>NS % energy from fat consumption</p> <p>NS 7-day and 6-month quit rates</p>	<p>Compared to workers who did not complete the final survey, completers were more likely to be older, male, white non-Hispanic, educated and white-collar</p>

TABLE 2

QUALITY ASSESSMENT RATINGS OF INCLUDED STUDIES

	Selection Bias	Allocation Bias	Confounder	Blinding	Data Collection	Withdrawal & Dropouts	Unit of Allocation	Unit of Analysis	Overall Quality Assessment
CHIP	WEAK	STRONG	STRONG	WEAK	STRONG ¹	STRONG	INDIVIDUAL	INDIVIDUAL	WEAK
PACE	WEAK	STRONG	STRONG	WEAK	STRONG ¹	WEAK	BUSINESS UNIT	INDIVIDUAL	WEAK
PHLAME – Team and Individual-based	WEAK	STRONG	WEAK	WEAK	MODERATE ¹	STRONG	WORKSITE	INDIVIDUAL	WEAK
TAKE HEART	MODERATE	STRONG	STRONG	WEAK	STRONG ¹ WEAK for smoking	STRONG	WORKSITE	WORKSITE	WEAK
WELLWORKS-2	WEAK	STRONG	STRONG	WEAK	WEAK ²	STRONG	WORKSITE	INDIVIDUAL	WEAK
Gomel et al., 1993	STRONG	STRONG	STRONG	WEAK	STRONG ¹	STRONG	WORKSITE	INDIVIDUAL	WEAK
HEALTHY DIRECTIONS	WEAK	STRONG	STRONG	WEAK	WEAK ²	STRONG	WORKSITE	WORKSITE	WEAK
HEALTHY WORKER	WEAK	STRONG	STRONG	WEAK	MODERATE ¹	STRONG	WORKSITE	WORKSITE	WEAK
HEALTHY WORKS	WEAK	STRONG	STRONG	WEAK	MODERATE ¹	MODERATE	WORKSITE	INDIVIDUAL	WEAK
Nisbeth et al., 1999	WEAK	STRONG	STRONG	WEAK	STRONG ²	STRONG	INDIVIDUAL	INDIVIDUAL	WEAK
WORKING WELL TRIAL	MODERATE	STRONG	STRONG	WEAK	MODERATE ²	STRONG	WORKSITE	WORKSITE	WEAK
WELLWORKS PROJECT	WEAK	STRONG	STRONG	WEAK	MODERATE ²	STRONG	WORKSITE	WORKSITE	WEAK
WORKING HEALTHY	MODERATE	STRONG	STRONG	WEAK	MODERATE ²	STRONG	WORKSITE	INDIVIDUAL	WEAK

¹combination biologic and self-reported measurements

²self-reported measurements only

Table 3

INTERVENTION STRATEGIES OF INCLUDED STUDIES

Reference	Population	Length of Intervention (months)	Theoretical framework	Environmental Policies	Organizational Culture	Occupational Health & Safety	Assessment & Feedback	Professional Instruction	Peer/ Employee Committee Led	One-on-one Counselling	Group Education/ Counselling	Tailored Intervention	Educational Materials	Activities	Financial Incentives	Plan Formulated Professional	Plan Formulated Collaborative	Based on stage of change	Social disclosure
CHIP	female, white collar	6	no					x			x		x	x	x				
PACE	male white-collar	9	yes				x	x				x	x			x			
PHLAME team-based	male, firefighters	6	yes				x		x			x	x				x		x
PHLAME individual	male, firefighters	6	yes				x			x		x	x					x	
TAKE HEART I&2	male, diverse	24	yes	x			x		x					x					
WELLWORKS-2	male, blue-collar	24	yes	x		x			x	x	x	x							
Gomel et al., 1993 (BC)	male, paramedics	12	yes				x	x		x		x	x		x	x			
HEALTHY DIRECTIONS	male, blue-collar	18	yes	x		x			x	x	x								
HEALTHY WORKER	white-collar	24	no					x			x				x				
HEALTHY WORKS	female only, blue-collar	18	yes				x		x			x							
Nisbeth et al., 1999	male only, white-collar	12	no				x	x		x		x							
WORKING WELL	male, blue-collar	24	yes	x	x				x				x	x					
WELLWORKS-1	male, blue-collar	24	yes	x		x			x				x	x					
WORKING HEALTHY	male, blue-collar	30	yes	x					x				x	x					

Table 4 **REPORTED OUTCOMES OF INCLUDED STUDIES**

X = significant at end of intervention
 x = significant at end of intervention but not significant at two-years follow-up
 O = not significant

Reference	Length of intervention (months)	BMI	weight	% body fat	BP systolic	BP diastolic	cholesterol	HDL	LDL	triglycerides	fruit	vegetables	fibre	fat	grain	meat	sodium	physical activity/exercise	max oxygen	aerobic capacity	heart rate	smoking cessation	smoking quit attempts
Nutrition and Physical Activity																							
CHIP	6	X	X	X	O	O	X	X		O	X	X		X	O	X	X	X			X		
PACE	9	O		X	O	O	X		X									X	O		X		
PHLAME TB	6	O							X		O	O		O				X	O				
PHLAME IB	6	O							X		O	O		X				O	O				
Nutrition and Smoking Cessation																							
TAKE HEART 1&2	24						O	O			O	O		O								O	O
WELLWORKS 2	24										O	O											O
Nutrition, Physical Activity and Smoking Cessation																							
Gomel et al., 1993	12	◇		O			X													O		O	
HEALTHY DIRECTIONS*	18										O	O				O		O				O	
HEALTHY WORKER	24		X																			O	
HEALTHY WORKS	18										X	X		O				O				O	
Nisbeth et al., 1999*	12	X	X		O	O	O	O	O	O										X		O	
WORKING WELL	24										x	x	O	x								O	
WELLWORKS 1	24										x	x	O	x								O	
WORKING HEALTHY	30										x	x	x	O				X				O	O

*only difference between intervention and control reported – not sub-groups
 ◇ significantly increased

REFERENCES

References for Included Studies are at the end.

Atkinson, R. L. & Nitzke, S.A. (2001). School based programmes on obesity. *British Medical Journal*, 323, 1018-1019.

Chapman, L.S., (2005). Meta-evaluation of worksite health promotion economic return studies: 2005 update. *The Art of Health Promotion*, 4, 1-11.

Chronic Disease Prevention Alliance of Canada (CDPAC). *The case for change*. Retrieved March 10, 2007, from <http://www.cdpac.ca/>.

Cochrane Reviewers Handbook 4.1.4. (2001). In M. Clarke & A. D. Oxman (Eds.), *The Cochrane Library*. Oxford: Update Software.

Deeks, J.J., Higgins, J.P.T., Altman, D.G., editors. (2006). Analysing and presenting results. In: J.P.T. Higgins, & S. Green, editors. *Cochrane Handbook for Systematic Reviews of Interventions 4.2.6* [updated September 2006]; Section 8. Retrieved March 10, 2007 from <http://www.cochrane.org/resources/handbook/hbook.htm>.

Dobbins, M., Lockett, D., Michel, I., Beyers, J., Feldman, L., Vohra, J., & Micucci, S. (2001). *The effectiveness of school-based interventions in promoting physical activity and fitness among children and youth: a systematic review*. The Effective Public Health Practice Project. Retrieved April 1, 2007 from <http://www.myhamilton.ca/myhamilton/CityandGovernment/HealthandSocialServices/Research/EPHPP/>.

Dobbins, M., & Beyers, J. (1999). The effectiveness of community-based heart health projects: a systematic overview update. The Effective Public Health Practice Project. Retrieved April 1, 1970 from <http://www.myhamilton.ca/myhamilton/CityandGovernment/HealthandSocialServices/Research/EPHPP/>.

Engbers, L.H., van Poppel, M.N.M., Chin, A., Paw, M.J.M., & van Mechelen, W. (2005). Worksite health promotion programs with environmental changes A systematic review. *American Journal of Preventive Medicine*, 29, 61-70.

Fine, A., Ward, M., Burr, M., Tudor-Smith, C., & Kingdon, A. (2004). Health promotion in small workplaces – a feasibility study. *Health Education Journal*, 63, 334-346.

Froom, P., Melamed, S., Kristal-Boneh, E., Benbassat, J. and Ribak, J. (1999). Healthy volunteer effect in industrial workers. *Journal of Clinical Epidemiology*, 52, 731-735.

Hara, M., Sasaki, S., Sobue, T., Yamamoto, S., & Tsugane, S. (2002). Comparison of cause-specific mortality between respondents and nonrespondents in a population-

based prospective study: ten-year follow-up of JPHC Study Cohort 1. *Journal of Clinical Epidemiology*, 55, 150-156.

He, K., Merchant, A., Rimm, E. B., Rosner, B. A., Stampfer, M. J., Willett, C. W. and Ascherio, A. (2003). Dietary fat intake and risk of stroke in male US healthcare professionals: 14 year prospective cohort study. *British Medical Journal*, 327, 777-782.

Health Council of Canada. (2006). *Health care renewal in Canada – Clearing the road to quality*. Retrieved March 10, 2007 from <http://www.healthcouncilcanada.ca/>.

Intersectoral Healthy Living Network. (2005). The integrated pan-Canadian healthy living strategy. Ottawa: Minister of Health. Retrieved from http://www.healthcouncilcanada.ca/docs/rpts/2006/References_HCC_2006_AnnualReport.pdf on March 10, 2007.

Jadad, A.R., Moore, R.A., Carroll, D., Jenkinson, C., Reynolds, D.J., Gavaghan, D.J., et al. (1996). Assessing the quality of reports of randomized clinical trials: is blinding necessary? *Controlled Clinical Trials*, 17, 1-12.

Katz, D.L., O'Connell, M., Yeh, M-H, Nawaz, H., Njike, V., Anderson, L.M., Cory, S., & Dietz, W. (2005). Public health strategies for preventing and controlling overweight and obesity in school and worksite settings. *Morbidity and Mortality Weekly Report*, 54, 1-12.

Kunz, R., & Oxman, A.D. (1998). The unpredictability paradox: a review of empirical comparisons of randomised and non-randomised clinical trials. *British Medical Journal*, 317, 1185-1190.

Kuhn, M., Doucet, C., & Edwards, N. (1999). Effectiveness of coalitions in heart health promotion, tobacco use reduction, and injury prevention: a systematic review of the literature 1990-1998. The Effective Public Health Practice Project. Retrieved April 1, 2007 from <http://www.myhamilton.ca/myhamilton/CityandGovernment/HealthandSocialServices/Research/EPHPP/>.

Matson-Koffman, D.M., Brownstein, J.N., Neiner, J.A., Greaney, M.L. (2005). A site-specific literature review of policy and environmental interventions that promote physical activity and nutrition for cardiovascular health: what works? *American Journal of Health Promotion*, 19, 167-193.

Micucci, S., Thomas, H. & Vohra, J. (2002). *The effectiveness of school-based strategies for the primary prevention of obesity and for promoting physical activity and/or nutrition, the major modifiable risk factors for type 2 diabetes: a review of reviews*. The Effective Public Health Practice Project. Retrieved April 1, 2007 from <http://www.myhamilton.ca/myhamilton/CityandGovernment/HealthandSocialServices/Research/EPHPP/>.

Ministry of Health and Long-Term Care, Public Health Division. (1997). *Mandatory Health Programs and Service Guidelines*. Retrieved March 10, 2007, from <http://www.health.gov.on.ca/english/providers/pub/pubhealth/manprog/manprog.html>.

Mulrow, C.D., Cook, D.J., & Davidoff, F. (1997). Systematic reviews: Critical links in the great chain of evidence. *Annals of Internal Medicine*, 126, 389-391. *Journal of Occupational and Environmental Medicine*, 47, 1051-1058.

National Center for Health Statistics. (n.d.) *NCHS Definitions*. Retrieved March 10, 2007 from <http://www.cdc.gov/nchs/datawh/nchsdefs/healthcondition.htm>.

Pelletier, K.R. (2005). A review and analysis of the clinical and cost-effectiveness studies of comprehensive health promotion and disease management programs at the worksite: update VI 200-2004. *Journal of Occupational and Environmental Medicine*, 47, 1051-1058.

Pinsky, P. F., Miller, A., Kramer, B.S., Church, T., Reding, D., Prorok, P., Gelmann, E., Schoen, R. E., Buys, S., Hayes, R. B. & Berg, C. D. (2007). Evidence of healthy volunteer effect in prostate, lung, colorectal, and ovarian cancer screening trial. *American Journal of Epidemiology*, Epub ahead of print. Accessed March 15, 2007.

Proper, K.I., Koning, M., van der Beek, A.J., Hildebrandt, V.J., Bosscher, R.J. & van Mechelen, W. (2003). The effectiveness of worksite physical activity programs on physical activity, physical fitness, and health. *Clinical Journal of Sports Medicine*, 13, 106-117.

Simpson, J.M., Oldenburg, B., Owen, N., Harris, D., Dobbins, T., Salmon, A., Vita, P., Wilson, J., & Saunders, J.B. (2000). The Australian National Workplace Health Project: design and baseline findings. *Preventive Medicine*, 31, 249-260.

Standing Senate Committee on Social Affairs, Science and Technology. (2002). *The Health of Canadians – The Federal Role*. Volume 6. Retrieved March 10, 2007 from <http://www.parl.gc.ca/37/2/parlbus/commbus/senate/com-e/SOCI-E/rep-e/repoct02vol6-e.htm>.

Statistics Canada. (2007). *Labour Force Survey. The Daily, March 9, 2007*. Retrieved March 19, 2007 from <http://www.statcan.ca/Daily/English/070309/d070309a.htm>.

Thomas, H., Ciliska, D., Dobbins, M. & Micucci, S. (2004). A process for systematically reviewing the literature: providing the research evidence for public health nursing interventions. *Worldviews on Evidence-Based Nursing*, 2, 91-99.

Thomas, H., Ciliska, D., Micucci, S., Wilson-Abra, J. & Dobbins, M. (2004). Effectiveness of physical activity enhancement and obesity prevention programs in children and youth. Effective Public Health Practice Project. Retrieved April 1, 2007 from <http://www.myhamilton.ca/myhamilton/CityandGovernment/HealthandSocialServices/Research/EPHPP/>.

Thomson, C.A., Harris, R.B., Craft N.E and Hakim I.A. (2005). A cross-sectional analysis demonstrated the healthy volunteer effect in smokers. *Journal of Clinical Epidemiology*, 58(4):378-382.

Viera, A.J., & Bangdiwala, S.I. (2007). Eliminating bias in randomized controlled trials: importance of allocation concealment and masking. *Family Medicine*, 39(2): 132-137.

INCLUDED STUDIES

CHIP

Aldana, S.G., Greenlaw, R.L., Diehl, H.A., Salberg, A., Merrill, R.M., & Ohmine, S. (2005). *The effects of a worksite Chronic disease prevention program*. *Journal of Occupational and Environmental Medicine*, 47, 558-564.

Gomel, M., Oldenburg, B., Simpson, J.M., & Owen, N. (1993). Work-site cardiovascular risk reduction: a randomized trial of health risk assessment education, counselling, and incentives. *American Journal of Public Health*, 83, 1231-1238.

HEALTHY DIRECTIONS – SMALL BUSINESS

Emmons, K.M., Stoddard, A.M., Gutheil, C., Gonzalez Suarez, E., Lobb, R., & Fletcher, R. (2003). Cancer prevention for working class, multi-ethnic populations through health centers: the healthy direction study. *Cancer Causes and Control*, 14, 727-737.

Sorensen, G., Barbeau, E., Stoddard, A.M., Hunt, M.K., Kaphingst, K., & Wallace, L. (2005). Promoting behaviour change among working-class, multiethnic workers: results of the Healthy Directions – Small Business Study. *American Journal of Public Health*, 95, 1389-1395.

Stoddard, A.M., Krieger, N., Barbeau, E.M., Bennett, G.G., Fay, M.E., Sorensen, G., & Emmons, K. (2005). Methods and baseline characteristics of two group-randomized trials with multiracial and multiethnic working-class samples [Electronic version]. *Preventing Chronic Disease*, 2(4), 1-11. Retrieved March 10, 2007, from <http://www.cdc.gov/pcd/issues/2005/oct/toc.htm>.

HEALTHY WORKER PROJECT

Jeffery, R.W., Forster, J.L., French, S.A., Kelder, S.H., Lando, H.A., McGovern, P.G., Jacobs, D.R., & Baxter, J.E. (1993). The Healthy Worker Project: a work-site intervention for weight control and smoking cessation. *American Journal of Public Health*, 83, 395-401.

Jeffery, R.W., Forster, J.L., Dunn, B.V., French, S.A., McGovern, P.G., & Lando, H.A. (1993). Effects of work-site health promotion on illness-related absenteeism. *Journal of Occupational Medicine*, 35, 1142-1146.

Schmitz, K., French, S.A., & Jeffery, R.W. (1997). Correlates of changes in leisure time physical activity over 2 years: the Healthy Worker Project. *Preventive Medicine*, 26, 570-579.

HEALTHY WORKS FOR WOMEN

Kramish Campbell, M., Tessaro, I., DeVellis, B., Benedict, S., Kelsey, K., Belton, L., & Sanhueza, A. (2002). Effects of a tailored health promotion program for female blue-collar workers: Health Works for Women. *Preventive Medicine*, 34, 313-323.

Nisbeth, O., Klausen, K., & Andersen, L.B. (1999). Effectiveness of counselling over 1 year on changes in lifestyle and coronary heart disease risk factors. *Patient Education and Counseling*, 40, 121-131.

PACE

Proper, K.I., Van den Heuvel, S.G., De Vroome, E.M., Hildebrandt, V.H., & W. Van der Beek, A.J., (2006). Dose-response relation between physical activity and sick leave. *British Journal of Sports Medicine*, 40, 173-178.

Proper, K.I., de Bruyne, M.C., Hildebrandt, V.H., W. Van der Beek, A.J., & Van Mechelen, W. (2006). Costs, benefits and effectiveness of worksite physical activity counselling from the employer's perspective. *Scandinavian Journal of Work and Environmental Health*, 30, 36-46.

Proper, K.I., Van der Beek, A.J., Hildebrandt, V.H., Twisk, J.W.R., & van Mechelen, W. (2003). Short term effect of feedback on fitness and health measurements on self reported appraisal of the stage of change. *British Journal of Sports Medicine*, 37, 529-534.

Proper, K.I., Hildebrandt, V.H., Van der Beek, A.J., Twisk, J.W.R., & Van Mechelen, W. (2003). Effect of individual counselling on physical activity fitness and health. A randomized controlled trial in a workplace setting. *American Journal of Preventive Medicine*, 24, 218-226.

Proper, K.I., Van der Beek, A.J., Hildebrandt, V.H., Twisk, J.W.R., & Van Mechelen, W. (2003). Worksite health promotion using individual counselling and the effectiveness of sick leave; results of a randomised controlled trial. *Occupational and Environmental Medicine*, 61, 275-279.

PHLAME

Elliot, D.L., Keuhl, K.S., Breger, R.K.R., Ernst, D.B. (2004). The PHLAME firefighters' study: feasibility and findings. *American Journal of Health Behaviour*, 28, 13-23.

TAKE HEART

Glasgow, R.E., Terborg, J.R., Hollis, J.F., Severson, H.H., & Boles, S.M. (1995). Take Heart: results from the initial phase of a work-site wellness program. *American Journal of Public Health*, 85, 209-216.

Glasgow, R.E., Terborg, J.R., Strycker, L.A., Boles, S.M. & Hollis, J.F. (1997). Take Heart II: replication of a worksite health promotion trial. *Journal of Behavioral Medicine*, 20, 143-161.

WELLWORKS

Sorensen, G., Stoddard, A., Hung, M.K., Hebert, J.R., Ockene, J.K., Avrunin, J.S., Himmelstein, J., & Hammond, S.K. (1998). The effects of a health promotion--health protection intervention on behaviour change: the WellWorks Study. *American Journal of Public Health*, 88, 1685-1690.

Sorensen, G., Stoddard, A., Ockene, J.K., Hunt, M.K., & Youngstrom, R. (1996). Worker participation in an integrated health promotion/health protection program: results from the WellWorks Project. *Health Education Quarterly*, 23, 191-2003.

Sorensen, G., Himmelstein, J.S., Hunt, M.K., Youngstrom, R., Hebert, J.R., Hammond, S.K., Palombo, R., Stoddard, A., & Ockene, J.K. (1995). A model for worksite cancer prevention: integration of health protection and health promotion in the WellWorks Project. *American Journal of Health Promotion*, 10, 55-62.

WELLWORKS-2

Hunt, M.K., Lederman, R., Stoddard, A.M., LaMontagne, A.D., McLellan, D., Combe, C., Barbeau, E., & Sorensen G. (2005). Process evaluation of an integrated health promotion/occupational health model in WellWorks-2. *Health Education & Behavior*, 32, 10-26.

Sorensen, G., Stoddard, A.M., LaMontagne, A.D., Emmons, K., Hunt, M.K., Youngstrom, R., McLellan, D. & Christiani, D.C. (2003). A comprehensive worksite cancer prevention intervention: behaviour change results from a randomized controlled trial (United States). *Journal of Public Health and Policy*, 24, 5-25.

Sorensen, G., Stoddard, A.M., LaMontagne, A.D., Emmons, K. Hunt, M.K., Youngstrom, R., McLellan D., & Christiani, D.C. (2002). A comprehensive worksite cancer prevention intervention: behaviour change results from a randomized controlled trial (United States). *Cancer Causes and Control*, 13, 493-502.

WORKING HEALTHY PROJECT

Emmons, K., Linnan, L.A., Shadel, W.G., Bess, M., & Abrams, D.B. (1999). The Working Healthy Project: a worksite health-promotion trial targeting physical activity, diet and smoking. *Journal of Occupational and Environmental Medicine*, 41, 545-555.

WORKING WELL TRIAL

Abrams, D.B., Boutwell, W.B., Grizzle, J., Heimendinger, J., Sorensen, G., & Varnes, J. (1994). Cancer control at the workplace: the Working Well Trial. *Preventive Medicine*, 23, 15-27.

- Basen-Engquist, K., Hudmon, K.S., Tripp, M., & Chamberlain, R. (1998). Worksite health and safety climate: scale development and effects of a health promotion intervention. *Preventive Medicine, 27*, 111-119.
- Biener, L., Glanz, K., McLerran, D., Sorensen, G., Thompson, B., Basen-Engquist, K., Linnan, L., & Varnes, J. (1999). The impact of the Working Well Trial on the worksite smoking and nutrition environment. *Health Education & Behavior, 26*, 478-494.
- Biener, L., Glanz, K., McLerran, D., Sorensen, G., Thompson, B., Basen-Engquist, K., Linnan, L. & Varnes, J. (1999). A worksite health promotion intervention improved employees' nutrition. *Health Education & Behavior, 26*, 478-494.
- Emmons, K.M., Thompson, B., McLerran, D., Sorensen, G., Linnan, L., Basen-Engquist, K., & Biener, L. (2000). The relationship between organizational characteristics and the adoption of workplace smoking policies. *Health Education & Behavior, 27*, 483-501.
- Gritz, E.R., Thompson, B., Emmons, K., Ockene, J.K., McLerran, D.F., Nielsen, I.R., & Working Well Research Group. (1998). Gender differences among smokers and quitters in the Working Well Trial. *Preventive Medicine, 27*, 553-561.
- Heimendinger, J., Feng, Z., Emmons, K., Stoddard, A., Kinne, S., Biener, L., Sorensen, G., Abrams, D., Varnes, J., & Boutwell, B. (1995). The Working Well Trial: baseline dietary and smoking behaviors of employees and related worksite characteristics. *Preventive Medicine, 24*, 180-193.
- Kristal, A.R., Patterson, R.E., Glanz, K., Heimendinger, J., Hebert, J.R., Feng, Z., & Probart, C. (1995). Psychosocial correlates of healthful diets: baseline results from the Working Well Study. *Preventive Medicine, 24*, 221-228.
- Patterson, R.E., Kristal, A.R., Biener, L., Varnes, J., Feng, Z., Glanz, K., Stables, G., Chamberlain, R.M., & Probart, C. (1998). Durability and diffusion of the nutrition intervention in the Working Well Trial. *Preventive Medicine, 27*, 668-673.
- Patterson, R.E., Kristal, A.R., Glanz, K., McLerran, D.F., Hebert, D.F., Heimendinger, J., Linnan, L., Probart, C., & Chamberlain, R.M. (1997). Components of the Working Well Trial intervention associated with adoption of healthful diets. *American Journal of Preventive Medicine, 13*, 271-276.
- Sorensen, G., Emmons, K., Stoddard, A.M., Linnan, L., & Avrunin, J. (2002). Do social influences contribute to occupational differences in quitting smoking and attitudes toward quitting? *American Journal of Health Promotion, 16*, 135-141.
- Sorensen, G., Thompson, B., Glanz, K., Feng, Z., Kinne, S., DiClemente, C., Emmons, K., Heimendinger, J., Probart, C., & Lichtenstein, E. (1996). Work site-based cancer prevention: primary results from the Working Well Trial. *American Journal of Public Health, 86*, 939-947.

APPENDICES

Appendix 1: Search Strategy

Appendix 2: Relevance Tool

Appendix 3: Quality Assessment Tool

Appendix 1: Search Strategy

The search will look for randomized trials:

- bibliographic databases (1990-2006): CCINFOweb, CINAHL, The Cochrane Central Register of Controlled Trials, EMBASE, ECONLIT, HealthSTAR (Ovid), PubMed, Nursing & Health Sciences (SAGE), PsycINFO
- government websites: Canada, United States, Australia, United Kingdom, Netherlands
- references cited on relevant websites:
 - The Health Communication Unit - www.thcu.ca/workplace,
 - Canadian Centre for Occupational Health and Safety (CCOHS) - www.ccohs.ca/,
 - Institute for Work and Health - www.iwh.on.ca/,
 - Healthy Workplace Week - www.healthyworkplaceweek.ca/,
 - Alberta Centre for Active Living - www.centre4activeliving.ca,
 - National Quality Institute - www.nqi.ca/,
 - U.S. Task Force on Community Preventive Services - www.thecommunityguide.org/.

Additional sources for primary studies will include:

- contents of key journals (2003-2006) will be searched by EPHPP staff: *American Association of Occupational Health Nurses, American Journal of Health Promotion, American Journal of Public Health, Canadian Journal of Public Health, Health Education Research, Journal of Occupational Health and Environmental Medicine, Journal of Occupational Medicine, Preventive Medicine*;
- references listed in the papers eligible for the systematic review will be scanned by EPHPP staff;
- articles identified by writing group members

Appendix 2. Relevance Tool

Relevance Criteria

1.	The study involves an intervention relevant to public health/health promotion practice consistent with Ontario's Mandatory Health Programs and Service Guidelines. Programs implementing pharmaceutical interventions are not relevant.	Y	N
2.	The study reports on an intervention targeted at changing behaviour (education, skill building, or supportive environment) in the workplace related to two or more of: diet/nutrition, physical activity, or smoking cessation. Government legislation or environmental or policy interventions for banning smoking in the workplaces are not relevant.		
3.	The study reports on a randomized controlled trial	Y	N
4.	The study implements the intervention in a population of working adults. Programs directed only to adults at high risk (people with diabetes or hypertension) are not relevant.		
5.	The intervention takes place in countries where workplace practices and standards are similar to those in Ontario: Canada, the United States, Australia, New Zealand, or Northwestern Europe (United Kingdom, Ireland, Norway, Sweden, Denmark, France, Belgium, Netherlands, Germany, Switzerland, Austria).	Y	N
6.	The study reports on a change in chronic disease rates, reduction in intermediate outcome biomarkers (body mass index, weight, % body fat, blood pressure, cholesterol, lipids, triglycerides), or behaviours that effects these biomarkers (improvement in nutrition, physical activity, smoking cessation rates, or environmental changes to encourage healthy eating, increased physical activity or smoking cessation).	Y	N
	Reviewer Decision		
	Include in critical appraisal (only if answer 'yes' to all 6 relevance criteria)	Y	N
	If Discrepancy in Inclusion Decision:		
	Reason for discrepancy		
	Oversight	Y	N
	Difference in interpretation of criteria	Y	N
	Difference in interpretation of study	Y	N
	Additional Comments:		
	FINAL DECISION INCLUDE IN STUDY	Y	N

Appendix 3: Quality Assessment Tool

COMPONENT RATINGS

A) SELECTION BIAS

(Q1) Are the individuals selected to participate in the study likely to be representative of the target population?

- 1 Very likely
- 2 Somewhat likely
- 3 Not likely
- 4 Can't tell

(Q2) What percentage of selected individuals agreed to participate?

- 1 80 - 100% agreement
- 2 60 - 79% agreement
- 3 less than 60% agreement
- 4 Not applicable
- 5 Can't tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

B) STUDY DESIGN

Indicate the study design

- 1 Randomized controlled trial
- 2 Controlled clinical trial
- 3 Cohort analytic (two group pre + post)
- 4 Case-control
- 5 Cohort (one group pre + post (before and after))
- 6 Interrupted time series
- 7 Other specify _____
- 8 Can't tell

Was the study described as randomized?

- No
- Yes

If NO, go to component C

If Yes, was the method of randomization described? (see dictionary)

- No
- Yes

If Yes, was the method appropriate? (see dictionary)

- No
- Yes

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

C) CONFOUNDERS

(Q1) Were there important differences between groups prior to the intervention?

- 1 Yes
- 2 No
- 3 Can't tell

The following are examples of confounders:

- 1 Race
- 2 Sex
- 3 Marital status / family
- 4 Age
- 5 SES (income or class)
- 6 Education
- 7 Health status
- 8 Pre-intervention score on outcome measure

(Q2) If yes, indicate the percentage of relevant confounders that were controlled (either in the design (e.g. stratification, matching) or analysis)?

- 1 80 – 100%
- 2 60 – 79%
- 3 Less than 60%
- 4 Can't Tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

D) BLINDING

(Q1) Was (were) the outcome assessor(s) aware of the intervention or exposure status of participants?

- 1 Yes
- 2 No
- 3 Can't tell

(Q2) Were the study participants aware of the research question?

- 1 Yes
- 2 No
- 3 Can't tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

E) DATA COLLECTION METHODS

(Q1) Were data collection tools shown to be valid?

- 1 Yes
- 2 No
- 3 Can't tell

(Q2) Were data collection tools shown to be reliable?

- 1 Yes
- 2 No
- 3 Can't tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

F) WITHDRAWALS AND DROP-OUTS

(Q1) Were withdrawals and drop-outs reported in terms of numbers and reasons per group?

- 1 Yes
- 2 No
- 3 Can't tell

(Q2) Indicate the percentage of participants completing the study. (If the percentage differs by groups, record the lowest).

- 1 80 -100%
- 2 60 - 79%
- 3 less than 60%
- 4 Can't tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

G) INTERVENTION INTEGRITY

(Q1) What percentage of participants received the allocated intervention or exposure of interest?

- 1 80 -100%
- 2 60 - 79%
- 3 less than 60%
- 4 Can't tell

(Q2) Was the consistency of the intervention measured?

- 1 Yes
- 2 No
- 3 Can't tell

(Q3) Is it likely that subjects received an unintended intervention (contamination or co-intervention) that may influence the results?

- 1 Yes
- 2 No
- 3 Can't tell

H) ANALYSES

(Q1) Indicate the unit of allocation (circle one)

community organization/institution practice/office provider client

(Q2) Indicate the unit of analysis (circle one)

community organization/institution practice/office provider client

(Q3) Are the statistical methods appropriate for the study design?

- 1 Yes
- 2 No
- 3 Can't tell

(Q4) Is the analysis performed by intervention allocation status (i.e. intention to treat) rather than the actual intervention received?

- 1 Yes
- 2 No
- 3 Can't tell

GLOBAL RATING

COMPONENT RATINGS

Please transcribe the information from the gray boxes on pages 2-4 onto this page.

A SELECTION BIAS

RATE THIS SECTION	STRONG	MODERATE	WEAK
-------------------	--------	----------	------

B STUDY DESIGN

RATE THIS SECTION	STRONG	MODERATE	WEAK
-------------------	--------	----------	------

C CONFOUNDERS

RATE THIS SECTION	STRONG	MODERATE	WEAK
-------------------	--------	----------	------

D BLINDING

RATE THIS SECTION	STRONG	MODERATE	WEAK
-------------------	--------	----------	------

E DATA COLLECTION METHODS

RATE THIS SECTION	STRONG	MODERATE	WEAK
-------------------	--------	----------	------

F WITHDRAWALS AND DROPOUTS

RATE THIS SECTION	STRONG	MODERATE	WEAK
-------------------	--------	----------	------

GLOBAL RATING FOR THIS PAPER (circle one)

- | | | |
|---|-----------------|---|
| 1 | STRONG | (four STRONG ratings with no WEAK ratings) |
| 2 | MODERATE | (less than four STRONG ratings and one WEAK rating) |
| 3 | WEAK | (two or more WEAK ratings) |

WITH BOTH REVIEWERS DISCUSSING THE RATINGS:

Is there a discrepancy between the two reviewers with respect to the component (A-F) ratings?

No Yes

If yes, indicate the reason for the discrepancy

- | | |
|---|---|
| 1 | Oversight |
| 2 | Differences in interpretation of criteria |
| 3 | Differences in interpretation of study |

FINAL DECISION OF BOTH REVIEWERS (circle one):

- | | |
|---|-----------------|
| 1 | STRONG |
| 2 | MODERATE |
| 3 | WEAK |