Physical Activity Interventions in the Workplace: A Review and Future for New Zealand Research.

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Abstract

Aim: To examine the worksite physical activity intervention literature and discuss whether the findings are applicable to New Zealand worksite environments.

Data sources: Information was sourced from major health databases using key words physical activity, intervention, worksite, workplace, and health promotion. The remainder of the literature search was directed from citations in the articles sourced from the original search.

Study selection: Studies included in the review were related to worksite physical activity programmes and/or interventions. Programmes that incorporated screening and other risk behaviour management (for example smoking or stress management) but no health-related physical activity were excluded.

Data extraction: The literature was systematically reviewed to evaluate the utility of worksite physical activity programmes for health in general and more specifically for their utility in application to New Zealand worksites. Effect size calculations were generated to quantify major studies.

Symphysis: Despite convincing potential, data show little conclusive evidence that worksite interventions do increase long-term adherence to physical activity, provide health benefits, reduce absenteeism, or improve productivity. Problems include contamination through self-selection, high attrition rates, and poor outcome measures. A scarcity of New Zealand worksite physical activity research currently exists with no published accounts of evidence-based programmes identified.

Conclusions: A comprehensive appraisal of worksite physical activity literature highlights the complexity of carrying out worksite physical activity interventions and drawing dose-response conclusions. Quality New Zealand research is needed to

understand the specifics of the New Zealand workplace and how activity programmes might affect worker behaviour.

Key Words: Physical activity, health, worksite, New Zealand, intervention

Running Title: Worksite physical activity interventions

Physical Activity and Health

Recent research provides strong evidence of the benefits of maintaining a physically active lifestyle. Evidence shows clear links between physical activity and the prevention and management of numerous chronic diseases [2]. The report of the US Surgeon General on Physical Activity and Health (1996) [27] synthesised the research and highlighted a need to promote regular, moderate intensity physical activity to reduce the incidence of such diseases. The Surgeon General concluded that significant health benefits could be gained from 30 minutes of accumulated moderate intensity physical activity on all, or most days of the week [18].

Although the instruments to understand population levels of physical activity in New Zealanders have been of limited efficacy and remain unvalidated with direct measures of physical activity, New Zealand physical activity levels are following a pattern apparent in other westernised countries including the USA, Australia, and Britain [18]. Data from the Sport and Physical Activity Surveys 1997, 1998 and 2000, show that at least 32% of New Zealand adults are too physically inactive to gain any health benefits [26]. New Zealand women and men have comparable physical activity levels, and New Zealand European, Maori, and Pacific adults show similar levels, 69%, 67% and 63% respectively. Other ethnic minorities are at greater risk of sedentary lifestyles as only 54% are regarded as sufficiently active [26]. Furthermore, a cost-effectiveness study estimated that a 5% increase in New Zealand physical activity levels would conservatively result in direct health care savings of $25 million per annum. Similarly, it was estimated that $160 million per annum would be saved if all New Zealanders fulfilled the recommended physical activity guidelines [1]. The

study did not include projected costs of obesity and diabetes epidemics in New Zealand, estimated at $303 million [17] and $170 million [18], respectively.

Worksite Physical Activity Interventions

There is a growing trend for workplaces to conduct physical activity and health programmes to help overcome the burden of lifestyle-related illness and increase worker productivity. Historically, corporations in the United States have implemented employee assistance packages incorporating smoking cessation, nutrition, stress management, and more recently health-related physical activity components. New Zealand companies are following with generalised initiatives such as the National Heart Foundation's Heart Beat Challenge, and numerous private providers tout corporate wellness services that include physical activity components.

Employer investment in a worksite physical activity program may reduce the traditional burdens of program participation, including time constraints and childcare. Such an initiative may also provide professional assistance to many employees that could not afford a physical activity program [12] and target groups that are difficult to reach under other circumstances, including males and ethnic minorities [25]. Worksites provide structure in a confined community, utilise contact channels, and exist as an environment that is supportive for health promotion and ultimately, behaviour change.

The economic burden of physical inactivity is important in the worksite, especially in the US, where employers are responsible for health care costs through insurance. A report commissioned by the Michigan Governor's Council on Physical Fitness, Health and Sports estimated the costs to employers of physical inactivity. Findings

suggested that four cents in every dollar spent on workers compensation were directly linked to physical inactivity [6]. Furthermore, lost productivity costs to businesses indicated that on average workers lost 16 hours (2 days) of work to absenteeism, 14.5 hours to short-term disability, and 131.5 hours (16 days) to limited functional ability per year. It was estimated that this resulted in lost productivity costs of US$8.6 billion in Michigan alone for 2002 [6]. However these findings should be treated with caution as absenteeism and reduced functional capacity may also be due to unreported causes of sick dependents, and unrelated stresses. A more comprehensive and robust statistical analysis would also have made the findings of this report more convincing. Nevertheless, the economic burden of inactivity for employers, and therefore the potential economic benefits of a more physically active workplace are considerable.

Typical approaches to worksite health promotion have been risk behaviour screening and health education. Health screening and risk appraisals seek to identify individuals at risk of chronic diseases and provide medical advice. As well as general health measures, screening may also incorporate sub maximal exercise stress testing. Health education seminars may involve health professionals providing more general advice. Other forms of physical activity promotion include on site fitness programs, equipment and facilities, and incentives for off-site facility use. While these initiatives may have some short-term benefit for employees, in isolation they have little chance of sustainable behaviour change. In many cases, workers who volunteer to be involved in such programmes, or use onsite fitness facilities, are already active.

How effective are worksite programmes?

An electronic search of major health databases sourced key worksite physical activity studies, with the remainder of the literature directed from citations in the articles sourced from the original search. Key words used in the search were physical activity, workplace, worksite, health promotion, and intervention. Literature sourced which did not report methods and outcome measures were discarded. Major systematic reviews of worksite literature by Dishman et al. [9], Shephard [24], and Proper et al. [21] were identified and should be used to supplement this review.

Several quantitative interventions of sufficient quality were identified. For each study the effect sizes of the outcomes were calculated to ascertain the magnitude of the intervention's success. Table 1 shows a summary of these effects. Effect size was calculated by dividing the difference in means (pre and post) by the pre-experimental standard deviation. Some studies show large magnitudes of change, whereas other studies showed limited success. Unfortunately many studies did not report means and standard deviations, and contact with these authors was futile. Therefore some effect sizes are unknown. Table 1 summarises key worksite physical activity interventions. Firstly, attrition rates are clearly demonstrated with two studies showing 94% [22] and 89% [13] drop out over the intervention period. To compound to attrition rates, one study reviewed used a small sample size [20], three had generalisability only to blue collar workers [13,19,20], and only one study focused on accumulation of habitual physical activity [13]. The majority of worksite research has developed exercise programs and/or health screening and education, rather than focusing on sustainable physical activity changes. These studies reiterate the problems that exist in worksite interventions research to date.

Table 1: Significant worksite physical activity intervention studies, research designs and outcome measures.

Study	Sample	Research Design	Setting	Activity Target	Outcome Measures	Intervention	Effect	Post-test	Effect Size
Blair et al (1986) [4]	N=2147	Nonrandomised, 4 companies in intervention group, 3 in control group	Johnson & Johnson	Vigorous energy expenditure 1000 cal/wk	Validated self-report	Health screening Health education Exercise	Reduced absenteeism	24 months	Unknown
Gomel et al (1997) [11]	N=431	Stations randomly assigned into 1 of 4 intervention groups	Sydney ambulance stations	Risk factors related to CVD	Multiple logistic function and Standardised composite equation	1 Health risk factor assessment (HRFA) 2 HRFA + educational resources + video 3 HRFA + counselling + manual 4 HRFA + goal setting + manual + incentives	Increased reduction in CVD factors in group 3, than all other groups Incentives worked only for a short period of time	12 months	Unknown
Nurminen et al. (2002) [17]	N=133 (N=260 initially recruited)	Randomised control group, assigned to experimental or control groups	Laundry work company	Individual exercise program and counselling, physiotherapy feedback and group worksite physical activity sessions	Absenteeism records Job satisfaction Work ability index	Work ability index was assessed at 3, 8, 12 and 15 months. Intervention group participated in worksite exercise training guided by a physiotherapist: 1 hr sessions/ 1xwk for 8 months	None	15 months	Unknown Satisfaction=0.57
Iwane et al.(2000) [11]	N=83 (N=730 initially recruited)	Nonrandomised	Manufacturing industry men	Habitual physical activity	BMI, VO_{2max}, BP, HR, serum lipids, autonomic nerve activity	Walk at least 10 000 steps/day, as measured by a pedometer	Reduced BMI, Reduced BP in hypertensive participants, decreased HR	12 weeks	Systolic BP=3.05 BP=3.8 VO_{2max}=1.42

							and sympathetic nervous system, increased VO2max, no change in serum lipids		
Oden et al. (1989) [18]	N=45	Randomised controlled trial	Blue collar workers	Gentle to vigorous physical activity	Productivity (number hours worked on product hours and quality yield), job stress and job satisfaction	Intervention group: Aerobics Walk/jog Bicycle ergometer Aerobic dance 3 x wk for 24 wks Control: No intervention	None	24 weeks	VO_{2max} = 0.93 % fat = 0.56 Work stress =0.32 Job satisfaction = 0.06 Productivity = 1.18 Quality = 0.32
Proper et al. (2003) [20]	N=28 (N=299 initially recruited)	Randomised controlled trial	Dutch civil servants	Fitness and nutrition lifestyle behaviour	Physical activity levels Cardiorespiratory fitness Prevalence of musculoskeletal symptoms BMI BP Total blood cholesterol	Intervention group: 7 x 20 minute long individual counselling sessions over 9 months based on PACE guidelines Both groups received written information about lifestyle factors only	Intervention group: ↑ energy expenditure ↓submaximal HR	None	Energy expenditure = 0.16 % fat = 0.22 Cholesterol = 0.2
Shephard (1992) [21]	N=1200	Nonrandomised	Canada Life Assurance Company	Aerobic, strength and stretching, 2-3d/wk, 30-45 min	VO_{2max}	Health education and onsite supervised exercise	Slight improvement in VO_{2max}	10 yr	Unknown

Large magnitudes of effect were shown in studies by Iwane et al. [13] and Oden et al. [20]. However, sample sizes may have distorted the results and in the case of Oden et al., the authors reported no significant findings. In the studies where body fat was an outcome, small effects were shown [20, 22], and from the known effect sizes, two studies reported changes from subjective measures. These outcome measures included work ability index [19], job satisfaction [19, 20], absenteeism [19] and productivity [20]. From these findings, the authors concluded that limited evidence exists for a reduction in absenteeism and inconclusive evidence subsists for job satisfaction and work stress.

Recent publication in worksite physical activity interventions has been limited. One reason for this may be the limited efficacy of interventions resulting in a non-publication bias. Published research on the effect of worksite physical activity programmes in relation to the direct benefits to the individual and the organisation has been equivocal. Little basis exists to demonstrate sustainable increases in health-related physical activity levels when using the workplace as a platform for intervention. Instead, worksite interventions may be effective simply as capacity-building ventures, but the behaviour modification may be temporary and any long-term sustainability remains undetermined [12].

Worksite physical activity interventions have documented small physiological changes in participants. These include positive effects on aerobic capacity [13, 24], muscle strength and flexibility, overall risk taking behaviour [24] body mass, blood pressure, cholesterol levels [10], and enhanced glucose control [16]. Changes in these risk parameters for chronic disease are encouraging and should not be overlooked.

Shephard et al. (1992) detected no difference in absenteeism between a supervised exercise group and control. However the experimental group had fewer drug purchases, doctor visits, and hospital stays [23]. Risk factor reduction is a worthy public health goal with clear economic benefits at the population level. Whether employers see this health-care role as part of their mandate without clear and immediate commercial benefits is unclear.

A range of workplace health promotion programs have been run in Australia, utilising different frameworks and occupational categories. Because of similarities between Australian and New Zealand worksites, we believe that these programmes are relevant in the New Zealand context. Unfortunately, much of the published research does not employ robust statistical analysis, therefore the effect size is difficult to determine. The Sydney Stairway to Health [3] intervention manipulated the worksite environment by placing two sets of motivational prompts at worksite elevators within a multi-storey building. The intervention lasted five months and unpublished data indicate that overall stair use increased by 5%, overweight people were less likely to use the stairs, and men and people aged under 30 years were more likely to use the stairs than women. Men increased stair use by 10%, and at the conclusion of the study, it was estimated that 58% of staff had gained a cardio-protective effect from the intervention [3].

Further Australian workplace initiatives include Climb Mount Everest and the National Workplace Health Project. The Australian National Heart Foundation developed an intervention encouraging workplace teams of 10 people to cumulatively climb the height of Mount Everest. This equated to each person climbing approximately 10

flights of stairs each day for a month to cover the 2 212 floors equalling the height of Mount Everest. In the first year (1991) 120 teams competed, but in 1999 over 600 teams were registered. Unfortunately evaluation is limited in this intervention, but enrolments suggest that this event is gaining popularity [3]. The National Workplace Health Project was a controlled trial that investigated the efficacy of behavioural and environmental approaches to worksite physical activity and nutritional choices through questionnaires and recalls. The project is ongoing with measures taken at baseline, 12 and 24 months, and acts as an audit that monitors worksite interventions over time [25].

Worksites – a good place to promote health in NZ

To the authors' knowledge, no published research has been conducted in a New Zealand workplace. Subsequently the outcomes discussed in this review have been solely from international studies. However, the potential applications to the New Zealand workplace are worth considering. Physical activity interventions in the worksite are a logical place to target a large segment of the adult population. Two thirds of New Zealanders over 15 years are involved in some form of paid employment. Trends in the labour force show increasing numbers of workers are working at least 50 hours a week. Currently 22% of workers are now working in a minimum of 50 hours per week, compared to 17% in 1987 [7]. Reasons for the increase in working hours include strong growth in the number of self-employed people and an increase in professional and managerial occupations.

Currently cancer, cardiovascular disease, and stress are the leading causes of worksite absenteeism in Australia [15]. Although similar data are not available for New

Zealand, it is likely that we follow a similar trend. An inverse relationship between these three diseases and physical activity exists. Logically, improving physical activity may reduce absenteeism, ultimately improving employee quality of life and reduce costs to the organisation. Also, providing education and opportunities to be active within the worksite may reduce the risk of other chronic lifestyle illnesses such as cardiovascular disease, hypertension, type II diabetes, obesity, certain cancers, and other lifestyle diseases related to physical inactivity [16]. Recent changes in the New Zealand Health and Safety in Employment Act do not necessitate worksites to offer physical activity programmes, but make employers responsible for managing the stress of employees [8]. Physical activity has a well-established dose-response effect on stress and anxiety symptoms [5] and should be considered as an effective preventative strategy by employers in the provision of due care.

Disadvantages of Worksite Physical Activity Interventions

Problems traditionally facing worksite interventions include low recruitment, high drop out rates and poor maintenance of the programmes, reinforced by the collapse of comparison groups, often because of the lack of framework implementation [24]. Quality research designs using procedures such as randomised-controlled trials will give solid evidence for the success of any intervention. In such a design participants are randomly assigned to intervention or control groups. Unfortunately such designs are difficult to justify to company management, more expensive, and participants are more difficult to recruit. Blinding the control group to the intervention is often impossible.

Often researchers find it easier to compare participants to non-participants based on voluntary enrolment or sustained participation, without controlling for baseline differences. This is flawed on many accounts as self-selection in the intervention group may have greater motivation, higher adherence levels, or greater efficacy to physical activity. This will inflate the intervention's success. Proper et al. (2003) cited the lack of inactive participants as a major limitation of their study. In the Dutch adult population, 26% were physically inactive and were not contemplating becoming active, yet only 1% of study participants fell into that category [22]. In any worksite health promotion programme evidence shows that 20-50% of employees participate [14].

Conclusions

This review has provided an overview of the worksite physical activity intervention literature. Common but serious flaws in design illustrate the complexity of the area, and provide direction for future interventions. Inconclusive evidence for job satisfaction, staff retention, productivity, and stress reduction indicate a chasm between scientific evidence and the practicality of implementing an intervention. Although we argue that worksite physical activity interventions are ineffectual, intuitively, it may be more a matter of employing the right interventions and measurements to see success. We have drawn similar conclusions to those expressed by others, that the methodologies limit any conclusions that can be drawn and further work is needed relating to experimental design.

We do need to understand the commercial sensitivity of developing successful worksite interventions. It is likely that a successful programme has had significant

financial commitment from that company, providing a competitive advantage. In this instance there is no need to reveal the details of the programme. This aside, unlike academic research projects, company-initiated projects do not necessarily result in publication. This is a time-consuming and often laborious task with little commercial benefit. As such we must understand the limitations of published literature in this context.

Evidence-based research is important, as it remains the only reasonable vehicle upon which we can base our decisions to build programmes. Critiquing the available worksite literature has identified gaps in New Zealand specific research. We advocate an assessment of the New Zealand workplace culture through independent quality research design and evaluation. Prior to conducting an intervention in a New Zealand setting, cultural factors including profession, ethnicity, gender, and risk behaviours should be identified. Data including time spent at the workplace, occupational physical activity, activity levels outside the worksite, and how employees commute to work are fundamental to understanding physical activity and its determinants in the New Zealand context. We recommend that such descriptive work needs to be undertaken in New Zealand worksite environments prior to further intervention. Also, any intervention should limit the methodological weaknesses compromising the utility of the outcomes. Both of these goals are challenging. However, the worksite remains a commonsense environment to conduct quality health promotion to increase health-related physical activity and relieve the burden of disease related to sedentenarism. The economic and social benefits of a physically active lifestyle are clear. A physically active workforce will benefit the company, the employees, their families, and the country.

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