Title of the paper

Lifestyle health promotion interventions for the nursing workforce: a systematic review

Brief title:

Health promotion for nurses

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ABSTRACT

Aims and objectives. Study aims were to identify the efficacy of lifestyle health promotion interventions intended to improve behavioural health risk factors and/ or behavioural or clinical outcomes of working-age nurses

Background. Nurses constitute around half the health workforce but global shortages and an ageing profile challenge future supply. The occupational hazards and stresses of nursing are well-known. Health promotion, possibly workplace-based, presents opportunities to safeguard the health of nurses.

Design. This was a systematic review undertaken in line with guidance for reviews in healthcare.

Methods. Seven electronic databases were searched from 2000-2011 and references of relevant papers. Two reviewers independently reviewed and critiqued retrieved papers, extracted data. Methodological features were described using the CONSORT checklists; risk of bias assessed using the Cochrane Handbook classification.

Results. With design inclusion criteria relaxed to include an uncontrolled trial, only three intervention studies were retrieved, from the US, Canada and Taiwan. All had limitations and high risk of bias, but benefits were reported. Outcomes included fewer cigarettes smoked during the intervention period, down from mean (SD) 20 (8) to 12 (9) per day ($p<0.001$); significantly reduced fat mass (0.68 versus 0.07kg; $p=0.028$) and significant gains across a battery of fitness assessments. The paucity of work focused on nurses' health behaviours was the important finding.

Conclusion. The workplace is a potentially fruitful location for health promotion intervention but nurses have seldom been recognised as a target participant group. Given the international priority ascribed to nursing workforce retention, this is a missed opportunity for occupational

health planning. Potential benefits to nurses' welfare and wellbeing may accrue from well-designed intervention studies.

Relevance to clinical practice. Nurse leaders have a key role in driving recognition, spearheading commitment and development of targeted, whole-organisation programmes to promote health profile improvement for the nursing workforce.

Keywords: systematic review, nursing workforce, lifestyle intervention, health risk factors, health promotion, cardiovascular

INTRODUCTION

Nurses constitute approximately half the health workforce and nurses' health is therefore a priority issue, particularly given current global nursing shortages and the ageing demographic profile of this workforce in Australia and first world countries (Australian Government Department of Health and Ageing 2008, Bhatt *et al.* 2010, National Health Workforce Taskforce 2009). In 2008 over one third of Australia's nurses were aged 50 years and older, an increase of 5% within 4 years (Australian Institute of Health and Welfare 2010). Workplace-based health promotion might represent an opportunity to improve and safeguard the health of this essential workforce. This review set out to identify the efficacy of lifestyle health promotion interventions intended to improve the major behavioural health risk factors affecting nurses and/ or behavioural or clinical outcomes of working-age nurses.

Background

As the nursing workforce ages the overall health of its members may decline, challenging the profession to care for the health of the public. Hence, the health of nurses is of concern beyond the profession itself. To date research on nurses' health has focused predominantly on occupational stress (Clegg 2001), health and safety, work-related injuries (Clarke *et al.* 2002, Nelson *et al.* 2003, Witkoski & Dickson 2010), psychological health effects and job satisfaction (Bourbonnais *et al.* 2005, Ruggiero 2005, Winwood & Lushington 2006). However, nurses are not immune from the major lifestyle health risks that affect the working-age population as a whole, such as overweight / obesity, poor diet (i.e. one low in fruit and vegetables/ fibre, high in fat/ sodium, with accompanying raised cholesterol levels), low physical activity, smoking and hazardous alcohol drinking. Lifestyle behaviours such as these are important because they increase risks for development of vascular disease and cancers, which are the biggest causes of mortality and morbidity in first world countries (Mendis *et al.*

2011). They are also important because these are potentially modifiable risk factors. There is good evidence demonstrating the efficacy of some health promotion interventions to reduce health risks with population groups.

Effective lifestyle interventions

Among the general public a wide variety of behavioural lifestyle interventions have demonstrated effective risk reduction in terms of weight loss or prevention of weight gain, improved diet, increased exercise and activity, smoking cessation and reduction of hazardous alcohol consumption. These include the following:

Obesity: Behaviours which prevent excessive weight gain and result in weight reduction include a healthy diet and regular physical activity, reducing the risk for hypertension and type 2 diabetes mellitus (Brown *et al.* 2009, Goldberg & King 2007). The best results are achieved and effects sustained longer when a combination of interventions are used (Gallagher *et al.* 2012, Goldberg & King 2007, Shaw *et al.* 2005, Shaw *et al.* 2006) .

Diet: Diets rich in fruits, vegetables, whole grains, low-fat dairy products, and unsaturated fats are recommended for primary and secondary prevention of multiple diseases, particularly cardiovascular disease and type 2 diabetes (National Health and Medical Research Council 2005). Interventions that have proven effective in improving diet include dietary advice and computer-tailored interventions (Goetz-Perry 2006, Neville *et al.* 2009) in combination with pharmacological treatment (orlistat or sibutramine; anti-obesity drugs that prevent fat absorption or enhance satiety) (Keller 2006) for sustained success.

Activity: Recommendations are for 30 minutes of aerobic activity that induces mild shortness of breath most days of the week (National Vascular Disease Prevention Alliance (NVDPA) 2009). For weight loss, physical activity duration has to be at least doubled (Goldberg & King 2007). Moderate achievements are seen in terms of self-reported physical activity and

cardio-respiratory fitness (Foster *et al.* 2005), reduced systolic and diastolic blood-pressure, and combined with dietary interventions, decreased incidence of type 2 diabetes (Barengo *et al.* 2007, Orozco *et al.* 2008, Tuah *et al.* 2011). Interventions based on walking, the most common physical activity, achieve similar effects (Murphy *et al.* 2007, Thomas *et al.* 2006).

Smoking: Smoking is a risk factor for multiple diseases (National Vascular Disease Prevention Alliance (NVDPA) 2009). Interventions effective in reducing smoking include medications such as nicotine replacement therapy (NRT), bupropion or varenicline, often combined with behavioural treatments such as self-help materials and behavioural support. Group interventions and individual counselling are effective, including counselling by telephone, and using interactive web-based methods or motivational interviewing techniques (Bala *et al.* 2008, Civljak *et al.* 2010, Lai *et al.* 2010, Stead & Lancaster 2005, Stead *et al.* 2006).

Alcohol consumption: Recommendations are for no more than two standard alcohol drinks/day for females and males, with increasing intake linked to increasing risk for cardiovascular and liver disease (National Health and Medical Research Council 2009). The best-known model of abstinence for people recovering from alcohol dependence is the Twelve-Step Facilitation approach used by Alcoholics Anonymous although there is little evidence that this model is better than any others (Ferri *et al.* 2006). Interventions including education, peer group influence via web interface or face to face contact and therapeutic contact, have demonstrated effectiveness both short and longer term (Hunter & Mazurek 2004, Khadjesari *et al.* 2011, McKay 2005, Moreira *et al.* 2009).

Hypertension and type 2 diabetes may develop as a consequence of the above risk factors and are significant additional risk factors for cardiovascular disease. Recommendations are for blood pressure levels at or below 140/90 for the general population but less than this for those with blood pressure sensitive conditions such as diabetes (National Heart Foundation of

Australia 2008). Control of blood glucose levels is important to prevent microvascular and macrovascular comorbidities associated with diabetes (Diabetes Control and Complications Trial (DCCT) Research Group 1993). The lifestyle interventions outlined have proven effective in lowering blood pressure (Aucott *et al.* 2005, Aucott *et al.* 2009, Mulrow *et al.* 2008, Neter *et al.* 2008, Siebenhofer *et al.* 2011) and reducing the incidence of type 2 diabetes in pre-diabetes and high risk groups (Norris *et al.* 2005, O'Keefe *et al.* 2008, Orozco *et al.* 2008, Penn *et al.* 2009). Lifestyle modifications recommended for prevention and management of hypertension include:

- 30 min of moderate aerobic exercise on most if not all days
- Cessation of smoking
- Waist measurement < 94 cm for men and < 80 cm for women, Body Mass Index (BMI) < 25 kg/m^2.
- Dietary salt restriction: ≤ 4 g/day (65 mmol/day sodium)
- Limited alcohol intake: ≤ two standard drinks per day for men or ≤ one standard drink per day for women (National Heart Foundation of Australia 2008).

In summary, maintaining weight within the normal range, eating a healthy diet, keeping active, avoiding smoking and excessive alcohol have all been demonstrated as effective means to reduce the risks for chronic disease. These lifestyle behaviours have been shown to be achievable with a range of readily available interventions for targeted participant groups.

Risk factor profiles of nurses

Nursing as an occupation is associated with particular health risks. Occupational stresses and health risks of nursing derive from, for example, musculoskeletal injuries, high stress levels

associated with shift working and/ or irregular hours, unremitting exposure to disease and death, and for some, to toxic chemical and pharmacological compounds (Clegg 2001, Hay & Oken 1972, Nelson *et al.* 2003, Tan 1991). Added to this, most nurses have limited autonomy or control over their workload, work organisation or working environment, features recognised as particularly health-risk-prone in civil service as well as nursing populations (Bosma *et al.* 1997, Clegg 2001). Epidemiological and observational studies of nurses are limited (aside from the US Nurses' Health Study) but have indicated levels of health risk factors amongst nurses at least equivalent or greater than population values (Dam *et al.* 2008, Schluter *et al.* 2011, Tucker *et al.* 2010).

The greatest insights into nurses' health derive from the Nurses' Health Study. This large-scale prospective cohort study (n77,782) has to date followed US female Registered Nurses (RNs) aged 30-55 years for 24 years. For these nurses, each lifestyle factor (smoking, being overweight, inactivity, more than moderate alcohol intake and low quality diet) independently and significantly predicted mortality (Dam *et al.* 2008). Of 8,882 deaths documented, 55% were linked to smoking, overweight, inactivity, and poor diet. Information from other countries is more scanty but in 2005, 50% of Canadian RNs (n3,132) did not meet physical activity recommendations, with more than 50% overweight (Tucker *et al.* 2010). In Ireland in 2007/2008 20% of nursing students at one university site smoked, and 95% consumed alcohol with 19% of females exceeding the recommended weekly limit (Burke & McCarthy 2011).

Smoking is the most frequently researched lifestyle risk amongst nurses. The Nurses' Health Study (n237,648) demonstrated current nurse smokers' mortality rates in excess of those for former smokers, and approximately twice that of never smokers of all ages; those who smoked were also more likely to have co-morbid conditions (Sarna *et al.* 2008). From the 2006 New Zealand Census, 13% of female nurses (n32,682) were smokers with the

highest smoking prevalence (30%) amongst female psychiatric nurses (Edwards *et al.* 2008). In Turkey, 45% (n239) of nurses were current smokers, substantially more than the adult female population (Sezer *et al.* 2007). Of 127 nurses who smoked at some point, 90% started smoking during or after nursing education, a different pattern of smoking initiation to that in developed countries. In a small study from China (n509), 2.6% of nurses smoked (Smith *et al.* 2005), with no smokers under 25 years and the highest smoking rate amongst nurses aged 45 to 50 years. These limited data indicate that patterns of smoking amongst nurses vary appreciably between countries, and at least in some countries and certain groups, the proportion of nurses who smoke is greater than in the general population.

Strategies to support smoking cessation efforts of nurses were flagged as an important issue in the US (Sarna *et al.* 2005). In the UK nurses felt the non-smoking policy was not effective in motivating nurse smokers to stop and that insufficient support was given to nurses who smoked (Bloor *et al.* 2006). Nurses asked for interventions similar to that provided for the general population, and for additional support targeting confidentiality about their smoking in terms of the general public, and counselling for shame and guilt in relation to their public image as nurses (Bialous *et al.* 2004). Reviewing possible relationships between workplace stress and nurses' smoking habits, no clear link was found between nurses' work environment and smoking initiation although barriers to smoking cessation were not examined (Perdikaris *et al.* 2010).

Workplace-Based Health Promotion Interventions

Most adults spend about half their waking hours at work. The workplace is a natural social network offering a means to reach large groups of people and recruit peer social support, making it a promising setting for health promotion (McEachan *et al.* 2008, Robroek *et al.* 2007) and indicating a role for healthcare managers (Whitehead 2006). However, whilst links

have been demonstrated between healthy workplace structures and the overall health of nurses, programmes have mostly targeted occupational stress and injuries rather than lifestyle health risk factors.

AIMS

The aim of this review was to identify the efficacy of lifestyle health promotion interventions intended to improve behavioural health risk factors and/ or behavioural or clinical outcomes of working-age nurses. Health promotion interventions encompass problem definition, identification of the mode of delivery and components of the intervention, their 'dosage', i.e. intensity or number of repetitions; agreement of outcomes in terms of improvements in health and/ or reduction in health risk factors, and the timing at which they are anticipated/ measured (Sidani & Braden 1998).

METHODS

Design

This was a systematic review undertaken in line with guidance for reviews in healthcare (Centre for Reviews and Dissemination 2009).

Search methods

As the guidance suggested, we established criteria for considering studies for this review.

Types of studies

Initially we intended that only studies using the most rigorous research methodologies to trial interventions were included: randomised controlled trials (RCTs), controlled clinical trials (CCTs, i.e. where participants were non- randomly assigned to intervention and control groups), and reviews of studies using these methods. In light of the little information

retrieved, we departed from this design criterion to include a study that tested an appropriate intervention. Resource limitations excluded non- English language publications.

Types of participants

We included working-age nurses (i.e. adults aged approximately 18-65 years and employed by virtue of a recognised recorded nursing qualification).

Types of interventions

We included all behavioural interventions, either singly or in combination, intended to improve health risk factors and/ or related clinical health outcomes in relation to:

- Overweight or obesity
- Diet (i.e. improving intake of fruit, vegetables and fibre, reduction in saturated fats and sodium)
- Physical activity
- Smoking
- Hazardous drinking

Types of outcome measures

Outcomes of behavioural interventions were either changes in risk factor indices or related morbidity or mortality. Risk factor changes included:

- Overweight or obesity: reduction in weight, BMI, waist or other anthropometric indices
- Changes in dietary intake of fruit and vegetables/ fibre, fat and/ or sodium; cholesterol or lipid levels
- Changes in physical activity levels
- Smoking: number of cigarettes smoked per day; cessation attempts and duration
- Changes in alcohol intake
- Clinical outcomes comprised related morbidity, including hypertension, with changes in systolic and/ or diastolic values, and type 2 diabetes, with changes in incidence/

prevalence or indices of glycaemic control such as HbA1c values. Longer-term related morbidity or mortality included incidence of Acute Coronary Syndrome; renal or liver failure; peripheral vascular disease; cerebrovascular disease; incidence of neuro-vascular complications of type 2 diabetes; cancers.

Search methods for identification of studies

a. We created comprehensive search strategies, run from January 2000 to December 2011. Electronic databases searched were the Cochrane Central Register of Controlled Trials (The Cochrane Library, 2011); MEDLINE and PubMed; EMBASE; CINAHL; PsycINFO; BioMed Central. The decade-plus date range was chosen to focus on relatively recent work to maximise relevance. One key journal was hand-searched. The search strategy used a combination of MESH terms and text words and was purposively broad, to capture the breadth of the field (Table 1).
b. References of all relevant retrieved studies and reviews were searched for additional trials.

Data extraction and quality appraisal

References from searches were downloaded into a bibliographic software package (EndNote X4.0.2). Data extraction entailed a three stage process.

Stage 1: Titles and abstracts of all papers were assessed by one reviewer to exclude clearly irrelevant material. A short-list of potentially relevant papers was created, including those where there was uncertainty.

Stage Two: Two reviewers independently checked the titles and abstracts based on selection criteria. The full text was retrieved if there was any doubt. In all cases agreement was achieved by discussion.

Stage Three: Information on participants, methods, interventions and outcomes of selected studies was extracted independently by two reviewers, using purposively-developed data extraction forms; agreement was achieved through discussion. We intended to use CONSORT and PRISMA checklists to identify methodological features of trials and reviews (Moher *et al.* 2009, Schulz *et al.* 2010), with risk of bias within selected studies assessed using the Cochrane Handbook classification (Higgins & Green 2011), encompassing selection, performance, detection, attrition and reporting bias.

Search outcome

The search produced 5,163 references and 18 additional publications were identified from reference lists of relevant papers and hand-search of the American Association of Occupational Health Nurses journal; 822 duplicate records were removed. Ninety five publications were downloaded after exclusion of 4,264 irrelevant publications. Two studies remained after removal of those not meeting inclusion criteria. One other study was initially excluded as its design was neither CCT nor RCT. The decision was taken to relax the design criterion to consider this study as it tested an appropriate intervention (Figure 1).

RESULTS

The Studies

The three included studies came from the United States, Canada and Taiwan; nurse participants worked in community health and acute hospitals. Tables 2a and 2b outline study characteristics, interventions and outcome methods.

Study interventions

Study objectives varied widely, from a single focus such as promoting smoking cessation and increasing physical activity (Chalmers *et al.* 2001, Yuan *et al.* 2009) to wider health mindfulness with an aspiration that more active mothers (nurses) would result in better role modelling and encouragement of activity in their children (Tucker *et al.* 2011). Interventions ranged from a relatively simple treadmill stepping exercise regime (albeit supported by considerable social-motivational input), to a suite of exercise activities and a smoking cessation educational-motivational intervention. Two interventions were at least partially workplace-based and for the third, nurses had the choice to use the smoking cessation programme either in self-directed or facilitator-supported modes (unless they resided in a location not accessible to a facilitator). A common element of all programmes was the incorporation of forms of social motivational support for participants: from intervention facilitators and/ or the peer group (Chalmers *et al.* 2001, Tucker *et al.* 2011), or from the research team and local Nurse Managers (Yuan *et al.* 2009). Feedback of progress in attainment of activity goals was used by two studies: through maintenance of an activity diary (Yuan *et al.* 2009) or from a waist-worn pedometer (Tucker *et al.* 2011). Two of the interventions were underpinned by established theories: the smoking cessation manual was based on the Stages of Change theory (Prochaska *et al.* 1993, Velicer *et al.* 1999) and the worksite physical activity intervention was based on principles of cognitive-behavioural and social learning theories (Tucker *et al.* 2011); two were developed from the researchers' previous intervention studies (Bramadat *et al.* 1999, Tucker *et al.* 1998) (Table 2b).

Results of studies

All studies reported some positive findings although the magnitude and trustworthiness varied. Relying on a self-report survey of numbers of cigarettes smoked and quit attempts at baseline and 8 weeks, 6 and 12 months post intervention, with post-intervention response

rates of 77%, 60% and 47%, 30 (26%) reported having quit at some point. Both intervention groups decreased the overall amount smoked over the 8 week intervention period, with 6 (5%) participants reporting not smoking at both 6- and 12-month assessments (Chalmers *et al.* 2001). With two groups of nurses who were mothers, both with relatively high levels of baseline activity, using established assessment methods Tucker et al's pilot study of a workplace activity intervention did not demonstrate significantly increased activity levels, but did reveal significant reductions in fat mass, fat index and percent fat ($p < .03$), although no change in lean mass, in the intervention group (Tucker *et al.* 2011). Introducing a treadmill into ward areas was a response to nurses' claims to have no time for or easy access to exercise facilities. Three months later, allowing for possible confounding factors, the intervention group using this performed significantly better on all components of an established fitness battery than a control group sticking to their normal routines. However, the stepping regime was not the entirety of this intervention, as participants received a physical fitness examination before (and after) the intervention, they tracked their progress in daily activity and heart rate records and their adherence to the regime was supported by their managers and by weekly visits from the research team who collected their records (Yuan *et al.* 2009) (Tables 2b,c).

Risk of bias and study quality

Studies were independently examined by two reviewers for selection, performance, detection, attrition and reporting bias (Higgins & Green 2011). Potential bias was identified arising from participant self-selection or allocation to intervention groups (Chalmers *et al.* 2001, Yuan *et al.* 2009) without randomisation or allocation concealment (Tucker *et al.* 2011). One study had no control arm (Chalmers *et al.* 2001), and no study included blinded outcome assessment. The quality of outcome instruments and assessment methods varied, from self-

report surveys (Chalmers *et al.* 2001) to established, reputable methods such as dual energy x-ray absorptiometry (Tucker *et al.* 2011). Final assessments were conducted at end of intervention phase (10 weeks, Tucker *et al.* 2011; 3 months, Yuan *et al.* 2009), and with follow-up at 12 months (Chalmers *et al.* 2001). Attrition rates were sometimes high (28% at end of intervention, 53% at 12 months: Chalmers *et al.* 2001), sometimes low (5.2% and 4.4% at end of intervention: Tucker *et al.* 2011, Yuan *et al.* 2009). Interventions were not always standardised, challenging replication (Chalmers *et al.* 2001). One was a pilot study (Tucker *et al.* 2011); all used convenience sampling and none were based on sample size calculations or reported study power.

DISCUSSION

As the nursing workforce ages it becomes increasingly important to identify effective and cost-effective lifestyle interventions to achieve better health behaviours and risk factor profiles (van den Berg *et al.* 2008, van den Berg *et al.* 2009). This should both benefit nurses and enable them to model exemplary health behaviours to their clients and other staff (Clarke 1991, Denehy 2008, World Health Organization 2007). However, this is the first review to focus on behavioural lifestyle interventions for nurses.

Limitations of this review include possible bias due to exclusion of non-English language literature and unpublished trials. Search strategies were purposively broad and it is unlikely that many English language publications were missed. The more than decade-long date range may have missed older work; however, older work may have been less relevant to contemporary healthcare contexts, and tracking references in retrieved publications revealed few studies predating 2000. Given a dearth of studies focused on nurses, evaluation of the effectiveness of lifestyle interventions with this participant group could not be undertaken.

A dearth of studies trialling health promotion interventions with nurses was the significant finding of this review. This review found three health promotion interventions tested with nurses published within more than a decade meeting (relaxed) review inclusion criteria. One further study, recruiting a mixed group of care staff including RNs at a nursing home in Norway, tested an intensive composite exercise, stress management and health education program (Tveito & Eriksen 2009). No reduction in the primary outcome of sick leave was found amongst their intervention group, although subjective health benefits were perceived by participants, albeit assessed via an instrument for which no validation data were supplied. Reference lists of relevant papers revealed two earlier trials of smoking cessation interventions. One, an uncontrolled trial (n149) of a self-help smoking cessation programme with a supportive worksite environmental module, was followed up at 12 months and evaluated by self-report (Gritz *et al.* 1988). The other, a trial of an individualised smoking cessation intervention with volunteer intervention and control groups of qualified and student nurses (n54, 56), was evaluated at 12 months by salivary cotinine measurements (Rowe & Clark 1999). Both studies reported benefits in terms of reductions and cessation of smoking, and quit attempts.

It was a surprise that lifestyle interventions, often nurse-led, with evidence of efficacy with general public populations, have so seldom been trialled with nurses, either individually or in workplace groups. The nursing contribution to care has been shown to significantly impact patient mortality and morbidity (Aiken *et al.* 2002, Duffield *et al.* 2007). Despite this and international nurse shortages (Buchan & Calman 2004), scant attention has been paid to the health risk profiles of nurses. Buchan and Aitken (Buchan & Aiken 2008) argue that the nursing ‘shortage’ is in part at least due to nurses’ unwillingness to work under present conditions. This is perhaps understandable given the widespread recognition of nursing occupational stresses and health risks such as injuries, high stress levels, shift working,

irregular hours, exposure to disease, death, toxic chemical and pharmacological compounds, with limited autonomy or control over their workload, work organisation or working environment (Clegg 2001, Hay & Oken 1972, Nelson *et al.* 2003, Tan 1991). Little surprise, then, if nurses express generally negative perceptions of their workloads, workplace stress, job satisfaction, recognition and rewards (Hegney *et al.* 2006), and have health risk factor profiles similar or worse than population values (Dam *et al.* 2008, Schluter *et al.* 2011, Tucker *et al.* 2010). Nurses are unlikely to be immune to the pressures that produce risk behaviours in the general population; in addition, smoking, alcohol abuse, overeating and consumption of high-fat, high-sugar diets are all recognised coping mechanisms for high-stress situations (Lindquist *et al.* 1997), including amongst nurses (Hope *et al.* 1998). Thus nursing is a priority workforce with recognised occupational health hazards, but limited information available of nursing health risk profiles, targeted by almost no reported health promotion intervention studies.

It is not the case that there are no interventions available. Whilst most reviews noted limitations due to methodological weaknesses and heterogeneity of interventions and participant groups, health promotion interventions targeting women and the general population have demonstrated benefits in terms of positive behaviour change and outcomes. Outcomes have included weight reduction linked to reduced hypertension and risk reduction for type 2 diabetes and the metabolic syndrome (Brown *et al.* 2009, Mulrow *et al.* 2008), improved diet quality (Giugliano & Esposito 2008), increased activity and reduced blood pressure (Barengo *et al.* 2007), smoking abstinence (Agboola *et al.* 2010).

Further, there may be additional gains from application of such interventions within the workplace setting. Large numbers of people may be accessed, ensuring peer support. Environmental smoking controls can support quit attempts, and influence the amount smoked; social norms, role modelling, peer support and peer pressure may encourage healthy

habits as daily routine (Albertsen *et al.* 2006, Barr-Anderson *et al.* 2011, Cahill *et al.* 2008, Stead & Lancaster 2005). Environmental manipulation of the workplace and work patterns may facilitate healthy choices (Foster *et al.* 2005, Ni Mhurchu *et al.* 2010).

Little can be inferred from the findings of the three studies retrieved for this review due to their methodological limitations. However, despite this, they indicate that workplace-based health promotion interventions may be feasible and beneficial for nurses. The high attrition rates of one study raised questions about the featured approach, and perhaps highlight the challenges of sustaining nurses' motivation in smoking cessation, and probably other behavioural change. However, participant engagement was well maintained with the other two studies, although sustainability beyond close of intervention was not examined. The need for good quality trials is clear, and future trials need to include strategies to maintain engagement and motivation long enough to embed healthy habits within daily life, for long-term sustainability.

CONCLUSION

The paucity of work uncovered by this review flags an important gap in occupational health and human resource management in healthcare. Service providers probably have the necessary skills and resources, as these are daily delivered for patients. Studies with nurses are long overdue, to test whether lifestyle interventions for nurses can positively influence individual welfare and wellbeing, and collectively impact organisational recruitment, retention and sickness absence.

Failure to consider the workplace, where full-time workers spend almost one quarter of their lives, as an environment for lifestyle improvement is a further omission. More studies are needed targeting workplace interventions including for multi-factorial and combinations of lifestyle health risks, taking account of the particular working patterns as well as

behaviours of nurses. Attention is required to workplace lifestyle intervention design, to engage and sustain nurses to achieve health goals. Lifestyle interventions often entail cognitive-behavioural constructs based on self-efficacy, self-regulation, goal-setting and feedback. As in one of the included studies, health belief and stage models of behavioural change (Becker 1974, Prochaska & DiClemente 1992) are commonly adopted, although with little from this or other studies to indicate how best to apply them (Tuah *et al.* 2011). More evidence is needed to determine whether any one theoretical approach may be more effective in any particular circumstances.

Studies need to identify major characteristics of successful interventions: content and components of the intervention (number of sessions, duration), and mode of delivery. Innovative data collection methods are required to achieve good quality evaluation data, including not just primary outcomes but success factors for intervention delivery. Comparative studies are required to identify the interventions most likely to succeed in both initiation and maintenance of lifestyle change. Adequate sample sizes are required to demonstrate relatively small, but clinically important differences between strategies in complex workplace situations. Longer follow-up is required to examine maintenance of behaviour change and evaluation of clinical end points such as mortality, hospitalizations and healthcare claims, cardiovascular and cancer incidences, lifestyle risk profiles as well as quality of life. This review has identified a whole programme in waiting.

RELEVANCE TO CLINICAL PRACTICE

Nursing management has a key role in spearheading recognition of the priority of behavioural health promotion for nurses. Leadership is required to drive commitment, to examine the health risk factors and morbidity (sickness) profiles of their workforce; to develop targeted, integrated, sustainable organisation-wide high quality, evidence-based risk factor reduction

programmes for nurses. Support will be required to establish high quality, rigorous evaluation strategies, to inform progressive programme refinement, maximise and demonstrate benefits. The challenges of this are recognised, especially in times of cost-containment and financial stringency, but the cost of not addressing this is even greater.

Contributions

Study design: LP; data collection and analysis: CWC, LP; manuscript preparation: CWC, LP.

Conflict of interest

None.

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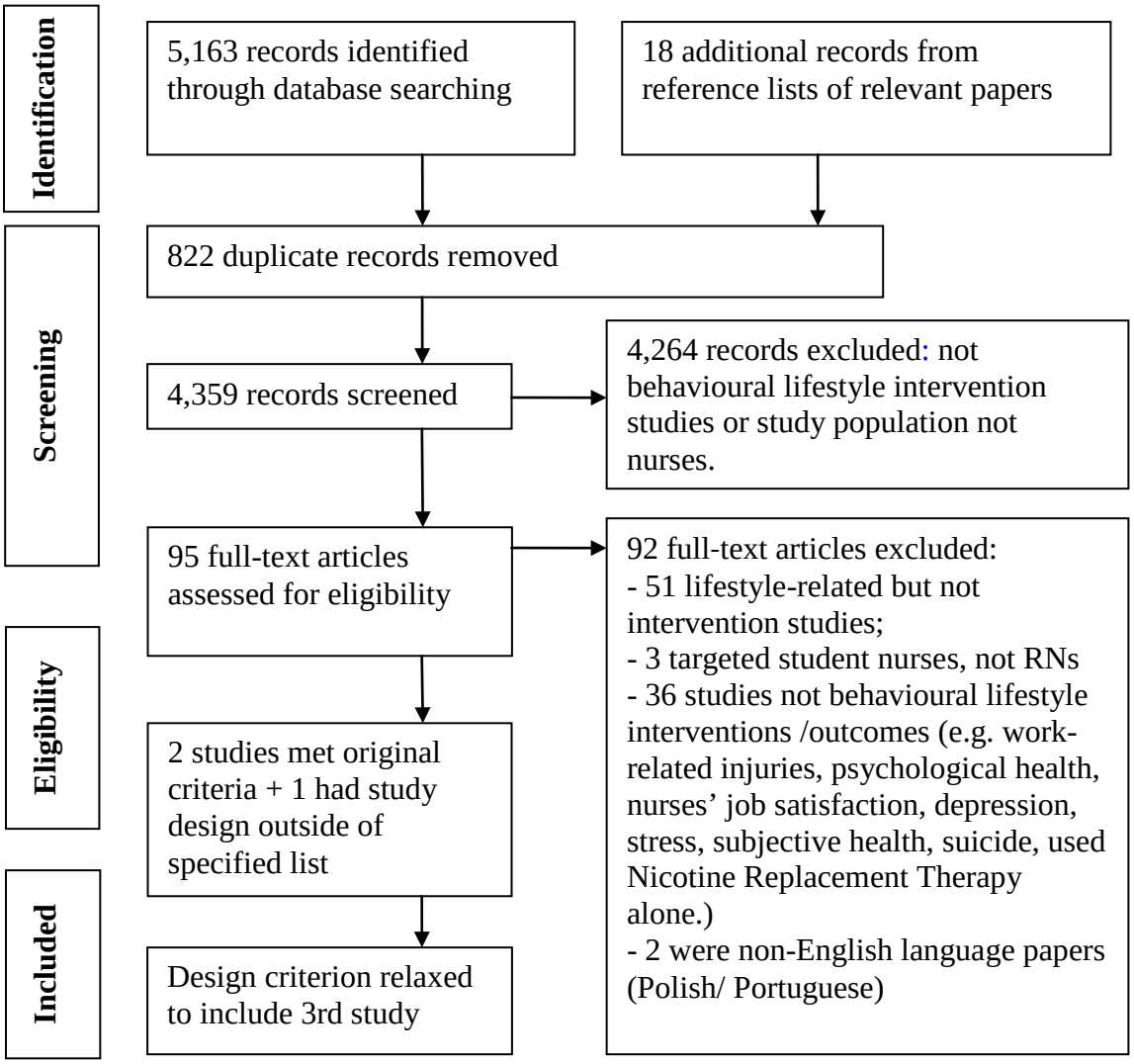

Figure 1 Publication selection flow chart.

Table 1 Example of search strategy for the database PsychInfo at OvidSP

	Search Term
1	(physical activity or exercise or fitness).af.
2	(diet or obesity or weight).af.
3	(smoking or cigarette$ or nicotine or tobacco).af.
4	(alcohol or hazardous drinking or abstinence).af.
5	(hypertension or blood pressure).af.
6	(diabetes or glucose tolerance or insulin).af.
7	(intervention or lifestyle or behaviour).af.
8	1 or2 or 3 or 4 or 5 or 6
9	7 and 8
10	(nurs$ not in-patient$ not inpatient$ not patient$).af.
11	9 and 10
12	limit 11 to (human and English language and ("reviews (maximizes sensitivity)" or "reviews (maximizes specificity)" or "reviews (best balance of sensitivity and specificity)" or "therapy (maximizes sensitivity)" or "therapy (maximizes specificity)" or "therapy (best balance of sensitivity and specificity)") and ("empirical study" or "experimental replication" or "followup study" or "longitudinal study" or "prospective study" or "literature review" or "systematic review" or “meta analysis” or “quantitative study” or "treatment outcome/randomized clinical trial") and adulthood <18+ years> and ("adulthood <age 18 yrs and older" or “age 30 to 39 yrs” or “age 40 to 64 yrs”) and human and yr="2000 -Current")

Table 2a Characteristics of included studies

Citation	Funding	Objective / hypothesis / research question	Study design	Study setting & duration	Sample - inclusion / exclusion criteria	Recruitment strategy	Participants: number, age, sex, other relevant description
Chalmers et al., 2001	Not stated	To evaluate a community-based smoking reduction and cessation program for Registered Nurses (RNs).	Participatory research	Community health practices in Manitoba, Alberta, Prince Edward Island, Canada; 12-month duration. No study date reported.	Convenience sample; RNs in employment; Registered Psychiatric Nurses excluded	Posters, notices in nursing journals, local presentations. Follow-up letters and telephone calls and tracing returned mail as strategies to minimize attrition.	n119, n117 usable pretest questionnaires. Age: 22-60 years, mean 40.6 years. 114 (97%) female nurses. 94 (80%) diploma in nursing; 95 (81%) worked in institutional, 94 (80%) in urban settings.
Tucker et al., 2011	Grant funded by Nat. Institutes of Nursing Research	To develop and pilot test the feasibility and preliminary effects of a worksite physical activity intervention for nurses who were working mothers.	A quasi-experimental design with staged implementation of the intervention across 3 study sites and concurrent recruitment of a control group. IG versus CG allocation	Acute hospital setting in the US; 10-week duration. Study date not reported.	Convenience sample of RNs from 3 medical-surgical wards; ≥1 year nursing, working at least half-time, with a child aged 1-16, English-speaking, non-smoking, aged 22-55 years, not pregnant/ breastfeeding, no acute/chronic illness, not	Intervention wards selected if Manager agrees to ward modifications. Participants recruited from these wards. Controls recruited via advertisements, flyers and e-mails within the hospital Stratified for equal representation of	n=58 white and non-Hispanic RNs; n30 Intervention Group (IG), n28 Control Group (CG). Mean (SD) age 35 (6.91) years; mean 31.5 hrs work per week; participants had 1-4 children each

			according to ward worksite.		normally taking vigorous exercise. Control participants worked in the same hospital but were excluded if they worked on intervention wards.	lean, overweight and obese RNs.	
Yuan et al., 2009	Funded by the National Science Council of Taiwan	To assess the effects of an exercise intervention on nurses' health-related physical fitness.	A quasi-experimental pre-post design with concurrent recruitment to IG and CG; method of group allocation not specified.	Medical centre in Taiwan; 3-month duration. Study dates not reported.	Volunteered sample from five nursing units. No detail of choice of units. Exclusion criteria: chronic diseases, severe musculoskeletal aches, pregnancy.	No detail.	Initially n45 each group, mean age: 35 (IG) and 31 (CG) years. Sex not stated. Over half of the participants were university educated.

Table 2b Characteristics of included studies, continued

Citation	Randomisation: sequence generation/ allocation	Blinding	Intervention details	Intervention integrity (adherence) and uptake	Outcome 1 (primary): definition, assessment methods; time points for collection/ reporting	Outcome 2: definition, assessment methods; time points for collection/ reporting
Chalmers et al., 2001	No randomisation; group allocation by participant preference/ access to facilitator. n44 and n75 nurses participated in the self-directed and facilitated groups, respectively	Not blinded. Participatory research methodology entailed participants working with the researcher. Data collected by self-report.	8-week intervention delivered in 2 forms: 1) self-directed, 2) facilitator supported. 'CloseUp' resource manual supplied to both groups, who were encouraged to use additional resources as desired.	Adherence to the intervention protocol not examined.	Self-report survey completed pre-intervention; at 8 weeks, 6 and 12 months post intervention. Primary outcomes were smoking cessation, numbers of cigarettes smoked, and nicotine dependence assessed using the Fagerstrom Nicotine Tolerance Scale.	At the same time points: attitudes to change, using the Smoking Process of Change Scale; perceived gains and losses of not smoking via the Decisional Balance Scale; confidence to resist smoking with the Self-Report Confidence Scale. Acceptable psychometric properties claimed for all scales.
Tucker et al., 2011	No randomisation	Not blinded	10-week intervention comprised 30-60 min introduction session, manipulation of the worksite, social reinforcements and a	Adherence to the intervention protocol not reported.	Baseline and post-intervention repeated measurements of physical exercise via an ankle-worn	Feasibility of integration of physical exercise intervention into work flow evaluated with IG focus group interviews.

			toolkit with options for engaging in physical activity at and away from work. Goal was for IG participants to achieve at least 1 hr per day extra activity with 30 min walking. Waist-worn pedometers used for physical activity feedback.		walking monitoring device and fat mass using dual energy x-ray absorptiometry (DXA).	
Yuan et al., 2009	No randomization. Five nursing units each assigned 8-10 voluntary participants to IG and CG.	Not blinded	3-month intervention. Each IG participant exercised daily (at least 3 times per week) after work on a stair-stepper for 20-30 minutes until their heart rate reached 70-80% of maximum (220-age). Exercise times and heart rates were self-recorded. The control group maintained usual work habits without any exercise intervention. Researchers visited weekly to monitor and encourage compliance and collect the	Adherence to the intervention protocol was not reported.	Labourer's Physical Fitness Test Method, comprising 5 indicators – BMI, grip strength, flexibility, abdominal muscle durability and cardiopulmonary durability – assessed with measures of height, weight, blood pressure, grip strength, sitting while bending forward, bent-knee sit-ups, prone back bend and 3-min	No other outcome measures stated.

	‘exercise record’. Unit Head Nurses supported and encouraged IG participants.	stair stepping test. Data were collected pre and post intervention.

Table 2c Characteristics of included studies, continued

Citation	Outcome analysis: summary data for each outcome: sample size, missing data, central tendency/ dispersion/ effect	Comments
Chalmers et al., 2001	119 nurses enrolled, 117 usable questionnaires at Time 1 pre-test; 90, 70, 55 at Times 2, 3 and 4 post-test: response rate 77%, 60% and 47%. 67 nurses (57.3%) reported previous quit attempts at Time 1. 30 (26%) quit at some point during the 12 months; of those, 19 (63%) had relapsed. Only 6 (5%) of 117 participants reported not smoking at both 6- and 12-month assessment points. There were no differences in quitting or relapsing patterns, or mean number of cigarettes smoked between the two intervention groups. Cigarettes smoked over the 8-week period (Time 1 - Time 2) decreased from mean (SD) 20 (8.02) (range 3 - 50, median 20) to 12 (9.15) (range 0-30, median 13) per day ($t(70)=6.71$, $n=71$, $p<0.001$). Two thirds of participants had moderately high levels of addiction to nicotine.	Authors claimed positive short-term outcomes, but not sustained during follow-up. They felt this highlighted the complexity of assisting nurses to quit smoking. High attrition rates over the 12-month study period made assessing nurses' long term outcomes difficult. High risk of bias made interpretation difficult.
Tucker et al., 2011	n30, n28 IG and CG participants, with 3 lost from IG. As a pilot study, no sample size calculation/ power were reported. No significant intervention effect for physical exercise levels between IG and CG; mean steps difference (SD) in daily physical exercise levels: 1424 (2985) intervention group versus 1358 (3089) control ($p=0.93$ and $p=0.95$ after baseline BMI adjusted). Significant differences in fat index ($p<0.027$), fat mass ($p<0.028$), percent fat mass ($p<0.035$) (but not lean mass) change over time favouring IG; differences remained significant after adjusting for baseline BMI. IG lost significantly greater fat mass (0.68 versus 0.07kg; $p=0.028$). Three focus groups held with n17 IG participants. Findings supported the feasibility of the intervention program, with recommendations for future programme development/	The worksite intervention was feasible in these volunteer wards. Authors claimed the approach was promising for the health of working mothers, and warranted further research to identify how the work setting can be leveraged to improve the health of nurses. High levels of baseline activity in both groups indicated a possible ceiling effect. There may have been an enrolment effect, and increased mindfulness of healthy lifestyle may have produced knock-on effects in areas such as diet, hence impacting fat mass. Social elements of the intervention were stressed as important to promote adherence.

	implementation.	
Yuan et al., 2009	Four CG participants did not complete, leaving n45 IG, n41 CG in the final data analysis, a drop-out rate of 4.4% After adjusting for confounding variables, indicators of fitness (except blood pressure) were significantly better in the IG compared to CG (all $p<0.05$).	A relatively simple exercise program could promote the health-related physical fitness of nurses, although the risk of bias was high and the study included substantial motivational support that might not be replicated if routinely available.