

Literature Review: Population Health; Total Worker Health

# Integrated Approaches to Occupational Health and Safety: A Systematic Review

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## Abstract

**Objective.** The study objective was to conduct a systematic review of the effectiveness of integrated workplace interventions that combine health promotion with occupational health and safety.

**Data Source.** Electronic databases ( $n = 8$ ), including PsychInfo and MEDLINE, were systematically searched.

**Study Inclusion and Exclusion Criteria.** Studies included were those that reported on workplace interventions that met the consensus definition of an “integrated approach,” published in English, in the scientific literature since 1990.

**Data Extraction.** Data extracted were occupation, worksite, country, sample size, intervention targets, follow-up period, and results reported. Quality was assessed according to American College of Occupational and Environmental Medicine Practice Guidelines.

**Data Synthesis.** Heterogeneity precluded formal meta-analyses. Results were classified according to the outcome(s) assessed into five categories (health promotion, injury prevention, occupational health and safety management, psychosocial, and return-on-investment). Narrative synthesis of outcomes was performed.

**Results.** A total of 31 eligible studies were identified; 23 (74%) were (quasi-)experimental trials. Effective interventions were most of those aimed at improving employee physical or mental health. Less consistent results were reported from integrated interventions targeting occupational health and safety management, injury prevention, or organizational cost savings.

**Conclusion.** Integrated approaches have been posed as comprehensive solutions to complex issues. Empirical evidence, while still emerging, provides some support for this. Continuing investment in, and evaluation of, integrated approaches are worthwhile. (*Am J Health Promot* 0000;00[0]:000–000.)

**Key Words:** Occupational Health, Occupational Safety, Occupational Health Promotion, Systematic Review, Occupational Health Management. Manuscript format: literature review; Setting: workplace; Health focus: physical activity, nutrition, smoking control, stress management, weight control; Strategy: education, behavior change, policy, culture change, built environment; Target population age: adults; Target population circumstances: education; income level

## INTRODUCTION

Integrated approaches to occupational health, safety, and well-being have been conceptualized in the international scientific literature for approximately two decades. A growing body of literature has emerged to support organizations and employers with the implementation of integrated approaches.<sup>1–4</sup> Despite this momentum, the empirical evidence describing the implementation or efficacy of integrated approaches to worker health, safety, and well-being is sparse.<sup>5</sup> In the climate of current interest for integrated approaches as an effective way forward for workplace health promotion, a review of the evidence is warranted and timely. This paper aims to systematically review the empirical evidence about integrated approaches to worker health, safety, and well-being.

Integrated approaches combine occupational safety and injury prevention with health promotion to protect and promote worker health, safety, and well-being.<sup>6–8</sup> Hymel et al.<sup>8(p695)</sup> define integrated approaches as “the strategic and systematic integration of distinct environmental, health and safety policies and programs into a continuum of activities that enhances the overall health and wellbeing of the workforce,

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This manuscript was submitted October 27, 2014; revisions were requested February 2, 2015; the manuscript was accepted for publication September 10, 2015.

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0890-1171/00/\$5.00 + 0  
DOI: 10.4278/ajhp.141027-LIT-542

and prevents work-related injuries and illnesses.” Underpinned by a socio-ecologic understanding of the source of risks to worker health, integrated approaches incorporate health promotion, organizational development, and psychosocial and physical working environments.<sup>6,9–13</sup>

A strong rationale for integrated approaches has been advocated from several bases, including clinical experience in diverse occupational settings<sup>8,14</sup>; partnerships with industry<sup>15</sup>; improving systems and organizational efficiency<sup>12,16,17</sup>; the complementary skill set of occupational health and health promotion practitioners<sup>12,15</sup>; and economic efficiencies.<sup>17</sup>

However, ascertainment of “integration” in the published scientific literature is difficult because the focus is on the reporting of intervention effects, rather than implementation and processes.<sup>5</sup> Terminology and focus are mixed between settings and countries. Efforts in the United States have been toward reducing individual health risks.<sup>3,18,19</sup> By contrast, the focus in Canada, Europe, and the United Kingdom has been toward optimizing psychosocial conditions in the workplace.<sup>2,20–22</sup> However, many of these recommendations are yet to be translated into workplace programs that could be subject to systematic evaluation; thus, evidence is in its relative infancy.<sup>15,23</sup>

Nonetheless, given the burgeoning interest in integrated approaches, a systematic review of extant evaluations of integrated programs that have been trialed is timely. Our overall purpose was to systematically review the empirical evidence about the effectiveness of integrated approaches that combine occupational health and safety (OHS) with health promotion (HP) to promote worker health, safety, and well-being. Our focus was to review interventions implementing an “integrated approach” rather than any one particular OHS outcome. Although understanding the effectiveness of integrated approaches targeting particular outcomes in specific sectors would be valuable, the evidence is not yet sufficiently developed to allow for these targeted research questions. Accordingly, our PICOS<sup>24</sup> criteria allow for a

broad range of settings and outcomes (Table 1).

## OBJECTIVE

The specific aims of this review were:

1. To systematically review the effectiveness of integrated interventions against the (individual, organizational, psychosocial, or environmental) outcomes; and
2. To investigate whether integrated approaches were more effective against targeted intervention outcomes than those using a more traditional “nonintegrated” approach.

## Operational Definition of Integrated Approaches

To derive an operational definition of “an integrated approach,” we adapted a core set of criteria<sup>3,4,25</sup> recently summarized by Sorensen et al.<sup>5(pS16)</sup> into four indicators: (1) organizational leadership and commitment; (2) coordination between health protection (OHS) and HP; (3) supportive organizational policies and practices; and (4) comprehensive program content. Studies meeting at least criteria (2) were included in the review.

## Method

A systematic review of the evidence was conducted. Reporting follows the recommended items outlined in the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA Statement).<sup>24</sup>

## Data Sources

English-language articles published in the peer-reviewed literature between January 1990 and September 2013 were searched (August–September 2013) from journals indexed in the following databases: MEDLINE, Embase, PsychInfo, CINAHL, Scopus, Web of Science, ProQuest, and The Cochrane Library. There were two search categories: those pertaining to OHS (e.g., occupational health/safety) and those identifying workplace HP (health promotion, wellness). Variations on the terms “integrated approach” were then applied (e.g., integrated, whole, total, combined, complete, comprehensive, holistic, whole worker). Cate-

**Table 1**  
**PICOS Definitions**

PICOS	Definition
Population	Employers/organizations/ worksites Australian and international Small-large enterprises All sectors
Interventions	Workplace program(s) implementing integrated approach(es) to worker health, safety, and well- being (i.e., occupational health and safety and well-being, health promotion), defined by study criteria
Comparison groups	Baseline data, or Preintervention group, or Control group
Outcomes	Employee health promotion Employee injury prevention, management; occupational health and safety management; psychosocial outcomes Organizational costs, direct and indirect
Study designs	Pre-post comparisons (Quasi-)Experimental trials

gories were combined with the Boolean operator “AND,” and search terms within each category were combined with “OR.”

## Inclusion and Exclusion Criteria

Inclusion and exclusion criteria are presented in Table 2.

## Protocol

A two-stage review process was applied (Figure). First, abstracts were reviewed by a first author (A.C.), and ineligible study designs were excluded. Full-manuscript review by two authors (A.C., N.J.) was conducted independently to ascertain eligibility. Adjudication was by a third author (E.H.) when there was not consensus.

## Data Extraction

Items in the data extraction form included: occupation, worksite, country, sample size, intervention targets, intervention content (referent group), follow-up period, results reported (Table 3). Items to assess methodologic quality were also extracted.

**Table 2**  
Study Inclusion and Exclusion Criteria

Eligible Studies Met All Criteria	Ineligible Studies Met Any Criteria
Evaluation of a workplace program or intervention	Reports of baseline data, etiologic data, qualitative, or study protocols; systematic reviews
Program managed internally within the workplace	External management (e.g., primary health care)
Demonstrated “integrated” according to Indicators of Integrated Approaches*	Reporting on programs/interventions with no evidence of integrated approach, or reporting insufficient information to ascertain an integrated approach

\* Sorensen et al.<sup>5</sup>

**Table 3**  
Summary of Included Studies (N = 31)\*

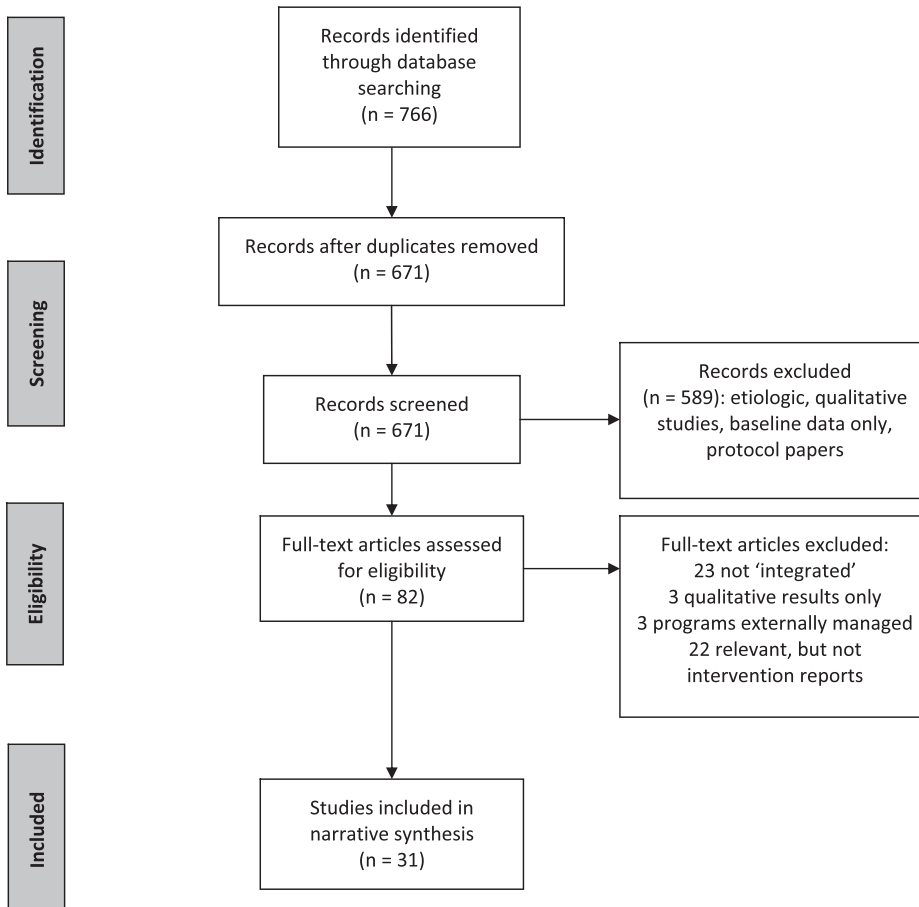
Characteristic	No. (%)
Year of publication	
1990–2000	8 (26)
2001–2009	14 (45)
2010–2014	9 (29)
Country	
Canada	2 (6)
United States	16 (53)
United Kingdom and Europe	12 (40)
Japan	1 (<1)
Industry type	
Manufacturing	14 (46)
Primary health care	7 (23)
Amenities supply	4 (13)
Government department	3 (10)
Protective services	2 (7)
Construction	1 (<1)
No. of outcomes assessed (range, 1–21)	
1–3	10 (33)
4–6	13 (42)
7–10	6 (19)
>10	2 (6)
No. of studies assessing†	
Physical health/behaviors	17 (55)
Safety and injury prevention	4 (13)
OHS management	3 (10)
Psychosocial	6 (19)
Costs	9 (29)
Process outcomes	5 (16)
No. of studies comparing integrated vs. standard interventions	4 (13)
Methodologic quality‡	
Low	5 (16)
Moderate	22 (71)
High	4 (13)

\* OHS indicates occupational health and safety.

† Total >100%, studies reporting on >1 outcome.

‡ American College of Occupational and Environmental Medicine guidelines (Harris et al.<sup>26</sup>); scores 0–3.5 are low quality; 4–7.5 are moderate quality; and 8–11 are high quality.

**Figure**  
Identification of Study Sample



### Assessment of Methodologic Quality

Study quality was assessed using the American College of Occupational and Environmental Medicine’s Practice Guidelines.<sup>26</sup> Studies were rated (0, not done/reported; 0.5, partially done/described; 1.0, fully conducted/reported) on 11 aspects of design, blinding, compliance, dropout, and analysis, yielding a total score range of 0 to 11 (scores: 0–3.5 were “low”; 4–7.5 were “moderate”; and >8 were “high” quality).

## Data Synthesis

The heterogeneity of study designs, interventions, and outcomes precluded the conduct of a formal meta-analysis. A narrative approach to data synthesis was conducted in three stages: (1) description of study characteristics; (2) assessment of methodologic quality; and (3) narrative synthesis of results to address study aims. For step (3), results from individual studies were classified as follows: employee health promotion, employee injury prevention and treatment, occupational health and safety management, psychosocial outcomes, and direct and indirect organizational costs.

## RESULTS

Of 671 abstracts screened, 82 were subject to full review, with 31 papers (24 separate studies) eligible for inclusion (Figure).

### Characteristics of Included Studies

Characteristics of included studies are presented in Table 3. Most studies ( $n = 22$ ; 71%) were classified as “moderate” quality, with four (13%) classified as “high” and the remainder “low” ( $n = 5$ ; 16%). Most were set in the United States, followed by the United Kingdom and Europe, and manufacturing was the most common industry represented.

Individual study summaries, including details of the integrated interventions, are presented in Tables 4 and 5. Most studies met more than the single indicator for integrated approaches based on the Sorensen et al.<sup>5</sup> criteria. Study samples ranged from 40 to 24,586 participants. A total of 14 studies (45%) were experimental trials with randomized group assignment; 9 (29%) were quasi-experimental trials comparing the intervention and a (nonrandom) referent group; and 8 (26%) were a single-group design relying on pre-post comparisons. With the exception of three studies following participants for 4 years,<sup>27</sup> 7 years,<sup>28</sup> and 10 years,<sup>29</sup> follow-up periods were brief, from 1 month to 3 years. Only two studies (four papers) compared an integrated “intensive” intervention with a nonintegrated “moderate” version of the intervention (Table 5).

### Intervention Targets and Outcomes Assessed

Most studies assessed between four and six primary and secondary outcomes (range, 1 to >10; total >100%). Targets of interventions, as well as outcomes reported, were classified and summarized (Table 3). Most focused on physical health/health behaviors ( $n = 17$ ; 55%), followed by analyses of costs ( $n = 9$ ; 29%), psychosocial outcomes ( $n = 7$ ; 23%), safety/injury prevention ( $n = 4$ ; 13%), or OHS management, with 5 process evaluations (16%). Most ( $n = 21$ ; 67%) reported on primary study outcomes that were intermediate “soft” indicators (e.g., health behaviors, safety protocols). Only 10 studies (32%) reported on “hard” outcomes: costs ( $n = 9$ ) or mortality ( $n = 1$ ).

### Summary of Effectiveness of Integrated Interventions (Study Aim 1)

Of the studies targeting employee health/health behavior (17 total, 14 separate interventions), outcomes assessed were tobacco use, weight management, physical activity, nutrition, self-rated health, chronic disease incidence, and mortality. Most studies ( $n = 9$ ) reported favorable effects against the targeted health outcomes.<sup>30–38</sup>

Fewer reported either mixed effects ( $n = 3$ )<sup>29,39,40</sup> or no effects ( $n = 2$ ).<sup>41,42</sup>

Integrated interventions targeting injury prevention and safety ( $n = 4$ ) focused on the prevention, treatment, or management of musculoskeletal disorders (MSDs), with three of these four studies sampling nursing/health care workers.<sup>43–45</sup> Two reported a decrease in the prevalence of MSDs,<sup>27,44</sup> one an increase,<sup>43</sup> and one no significant effects on incidence.<sup>45</sup>

Three studies assessed OHS management (OHS program content, organizational health/safety climate). In two instances these studies reported improvements in some, but not all, aspects of the health and safety climates evaluated: Kines et al.<sup>46</sup> and Basen-Engquist et al.<sup>47</sup> LaMontagne et al.<sup>48</sup> found improvements to “management commitment and employee participation” from the WellWorks-2 cancer-prevention intervention, but there were no significant effects on other elements of OHS functions

assessed (worksite analysis, risk prevention, OHS training and education).

Four studies of moderate to high quality (scores 4–8) showed promising effects on several indicators of the psychosocial work environment, including improved job quality,<sup>39</sup> reduced occupational stress,<sup>49</sup> reduced symptoms of depression,<sup>41,50</sup> and improved psychological resources.<sup>50</sup> Two studies reported a mixed pattern of effects on occupational stress and psychological resources.<sup>37,51</sup>

Of the nine studies reporting on various cost-related outcomes, findings were equivocal. Five studies reported favorable effects on absenteeism, leave usage, or short-term disability days.<sup>28,39,41,44,52</sup> Four reported few or no effects on cost outcomes (health care costs, sick leave).<sup>31,37,43,45</sup>

### Effectiveness of “Integrated” Compared With “Standard” Interventions (Study Aim 2)

Four papers (two studies) compared standard HP interventions with interventions integrating HP with OHS. The WellWorks-2 study compared a cancer risk-reduction intervention in two modes: HP only, and integrating HP with workplace environmental amelioration of exposure to occupational hazards (HP-OHS arm). Hunt et al.<sup>53</sup> found increased participation per intervention activity (21.1% vs. 14.2%), longer duration of worker exposure to the intervention activities (33.3 vs. 14.9 minutes), and higher overall mean participation (45.8% vs. 34.4%) for employees in the integrated worksites (HP-OHS), compared with those in the standard (HP-only) delivery worksites. Further, blue-collar workers had a higher smoking cessation rate in the integrated arm (11.8% vs. 5.9%).<sup>36</sup>

Goetzel et al.<sup>32</sup> compared a *moderate* (HP-only) intervention with an *intense* intervention integrating HP with organizational change. Both interventions stabilized employee body mass index (BMI), where BMI increased in control sites, but there were no additional intensity effects on other employee outcomes (blood pressure, nutrition, smoking and alcohol use, stress). Improvements in physical activity and cholesterol (intense arm) disappeared once analyses controlled for clustering effects. Significant mean score im-

**Table 4**  
**Summary Characteristics and Results of Studies Reporting on Integrated Interventions (All Comparison Groups; n = 27)\***

Source	Occupation/ Workplace/ Country (No.)	Target of Intervention	Indicators of Integrated Approaches†	Intervention (Control or Comparison Group)	Follow- Up	Effectiveness Against Targeted Outcomes	Quality Score‡
Badii et al., <sup>43</sup> 2006	Health care workers/ acute-care hospital/ Canada (N = 216)	Musculoskeletal injury	Coordination HP-OHS	Workplace modification; early identification; therapy; work accommodation while in recovery; access to on- site physician (control historical data)	12 mo	Increased rate (per 100,000 h) MSDs at intervention site (7.6–9.2; 0.02); reduced RR (1.0) for time loss compared with historical data (RR = 1.14, <i>p</i> < 0.001); null results medical costs	1.5
Barbeau et al., <sup>30</sup> 2006	Iron worker apprentices/ multiworksite training program/ United States (N = 337)	Reduction and cessation in tobacco use	Coordination HP-OHS; comprehensive program content	Health education; smoking cessation support group; nicotine therapy; health promotion materials and incentives delivered within OHS training (single group pre-post design)	1 mo	Participants OR = 3.0 for quitting; increased intention to quit participants vs. controls (50% vs. 20%; <i>p</i> = 0.006); decreased intensity (66.7% vs. 17.7%; <i>p</i> < 0.0001) and frequency (52.4% vs. 14.9%; <i>p</i> = 0.001)	3.5
Basen-Engquist et al., <sup>47</sup> 1998	Blue-collar and white- collar employees/40 gas and electricity suppliers/United States (N = 6867)	Organizational health and safety climate	Coordinated management strategies; comprehensive program content; coordination HP- OHS	Lifestyle cancer prevention (diet, smoking); education, support, and relapse prevention via health promotional activities, classes, self- help, and group support (matched worksites, standard health promotion materials only)	3 y	Organizational health climate increased ( <i>F</i> = 7.57, <i>p</i> = 0.009); no main effect safety climate; electrical worksites decreased safety climate at follow-up ( <i>F</i> = 6.02, <i>p</i> = 0.02)	7.5
Bergström et al., <sup>31</sup> 2008	Blue-collar and white- collar staff/4 manufacturing worksites/Sweden (N = 4894)	Health behaviors; HRQoL; sick leave usage	Comprehensive program content; coordinated management and employee engagement; coordination HP- OHS	Clinical examination and rehabilitation for individual “at risk” employees; work group- level survey feedback to address psychosocial climate (single-survey feedback at baseline for 1 worksite)	3.5 y	Significant reduction in smoking over time for 3 (of 4) sites; no change in exercise habits; 2 (of 4) companies improved HRQoL; 1 site reported decreased sick leave	4.0
Curwin et al., <sup>27</sup> 2013	White-collar staff/12 sites govt. department/Canada (N=233)	Musculoskeletal injury	Coordinated management strategies; comprehensive program content; coordination HP- OHS	Education workshops and written material; workplace assessment; individual consultations and referral; strength training (baseline data)	4 y	MSD prevalence reduced 6%– 12% in 8 sites; decreases in shoulder (14%–6%) and hip (8%–3%) injuries; decreased upper back (14%–5%) and lower back (23%–12%), but not other pain regions; proportion those reporting 0–2 pain regions increased (43%– 60%; <i>p</i> < 0.0001)	3.0
Cunningham et al., <sup>45</sup> 2008	Health care workers/ hospital/Ireland (N = 228)	Back pain	Coordination HP-OHS; coordinated management strategies; comprehensive program content	HP campaigns tailored for managers, staff, and clinicians; establish integrated database and management path, across a 2-y period (baseline data)	2 y	Improvement in attitude and belief mean scores; improved intention to self- manage back pain (e.g., remain active; 22%–36%; <i>p</i> = 0.001); no decrease in leave due to back pain	3.0
Elliot et al., <sup>33</sup> 2007	Firefighters/5 fire departments/United States (N = 696)	Nutrition; weight; physical activity	Coordination HP-OHS	Individual-delivery motivational counseling; team-centered delivery (control group written info only)	3 mo	Both intervention groups (cf. control): cholesterol ( <i>F</i> = 4.06, <i>p</i> = 0.03); individual arm better diet ( <i>F</i> = 4.06, <i>p</i> = 0.03), decreased depression ( <i>F</i> = 3.34, <i>p</i> = 0.05); team delivery increased exercise; no effects on BMI, oxygen, fruit/vegetable intake	8.5

**Table 4, Continued**  
**Summary Characteristics and Results of Studies Reporting on Integrated Interventions (All Comparison Groups; n = 27)\***

Source	Occupation/ Workplace/ Country (No.)	Target of Intervention	Indicators of Integrated Approaches†	Intervention (Control or Comparison Group)	Follow- Up	Effectiveness Against Targeted Outcomes	Quality Score‡
Elo et al., <sup>49</sup> 1998	Employees/ manufacturing co./ Finland (N = 118)	Stress reduction	Coordinated management and employee engagement strategies; coordination HP- OHS	Survey feedback method (baseline data)	3 y	Improved job variability ( $\chi^2 = 10.7, p < 0.03$ ); reduced mental ( $\chi^2 = 16.5, p < 0.002$ ) and physical ( $\chi^2 = 10.1, p < 0.0$ ) stress	4.0
Kawakami et al., <sup>41</sup> 1997	Blue-collar employees/ electric co./Japan (N = 297)	Stress reduction	Coordinated management; comprehensive program content; coordination HP- OHS	2 sites: staff and supervisors identify stressors and solutions, and implement changes to work processes (3- site control group)	2 y	Reduced depression ( $F = 3.41, p = 0.04$ ); reduced sick leave ( $\chi^2 = 10.4, p = 0.03$ ); no effect blood pressure; overtime; stressors	5.0
Kines et al., <sup>46</sup> 2013	Employees/14 SMEs metal industry/ Denmark (N = 202)	Injury prevention; safety culture	Processes for manager accountability and training; coordinated management and employee strategies; coordination HP- OHS	8 sites: safety coaching for owner/manager; consultations with staff; survey feedback (8-site matched control)	6 mo	Improvement on 6 (of 8) safety culture indices; no effect on worksite safety index	7.0
Kuehl et al., <sup>28</sup> 2013	Firefighters/4 fire departments/United States (N = 1369)	Worker compensation claims; medical costs	Coordination HP-OHS	2-site intervention (see Elliot et al., <sup>33</sup> 2007) (2- site matched control)	7 y	8% reduction in total WC claims (vs. 13% increase control departments); claims rate 28% vs. 32% ( $p < 0.001$ ); 7% increase per head (cf. 24% increase); ROI: 1.8–4.6 to 1	5.0
LaMontagne et al., <sup>48</sup> 2004	15 large manufacturing worksites/United States	OHS program content	Coordination HP-OHS	7 intervention (see Sorensen et al., <sup>36</sup> 2002) (8 control sites)	2 y	Improvement management commitment/employee participation element (mean change, 2.89; $p = 0.03$ ), but not other 3 elements of OHS content	8.5
Maes et al., <sup>39</sup> 1998	Employees/3 sites manufacturing co./ Netherlands (N = 264)	Health behaviors; stress; work quality; absenteeism	Coordination HP-OHS; processes for manager accountability, training; coordinated management and employee strategies	1 intervention site: health education; training for management; environmental change and wellness committee; continual improvement (2 control sites)	3 y	No effect health behaviors; reduced cholesterol males only ( $F = 5.61, p = 0.02$ ); no effect stress; improved job quality; reduction in absenteeism	5.0
Nelson et al., <sup>44</sup> 2006	Nurses/23 acute care hospital units/United States (N = 300)	Injury rates; lost days; job satisfaction; unsafe incidents; ROI; med costs	Coordination HP-OHS	Intervention protocol for ergonomic assessment; patient handling, lifting, policies, and procedures (baseline data)	9 mo	Reduced injury rate 24% vs. 17%; reduced days modified duties, median, 6.2 vs. 10.2; no effect lost work days; decreased unsafe incidents; increased job satisfaction; savings of \$245,727	3.5
Okechukwu et al., <sup>40</sup> 2009	Construction apprentices/10 sites/ United States (N = 1213)	Smoking cessation	Coordination HP-OHS	Intervention (4 sites) delivered within OHS curriculum, group counseling; quit kits; environmental messages and supports (waitlist control 6 sites)	6–9 mo	Short-term quit rates 26% vs. 16% (OR = 1.62) not sustained at 6 mo; reduced smoking intensity (OR = 3.1) sustained; no effect smoking frequency, quit attempts, or intention	6.5
Ott et al., <sup>29</sup> 2010	Cohort employees/ manual, skilled production/Germany (N = 24,586)	Chronic disease incidence; mortality	Coordination HP-OHS; comprehensive program content	Health seminar program incorporating ergonomics, lifestyle, stress, coping, and physical activity (baseline data)	1–10 y	No effect on disease incidence; reduced mortality of 13%–17% estimates	4.5

**Table 4, Continued**  
**Summary Characteristics and Results of Studies Reporting on Integrated Interventions (All Comparison Groups; n = 27)\***

Source	Occupation/ Workplace/ Country (No.)	Target of Intervention	Indicators of Integrated Approaches†	Intervention (Control or Comparison Group)	Follow- Up	Effectiveness Against Targeted Outcomes	Quality Score‡
Peterson et al., <sup>51</sup> 2006	Nursing staff/14 elder-care units/Sweden (N = 200)	Self-reported health; health resources	Coordinated management and employee engagement strategies; comprehensive program content; coordination HP-OHS	Intervention: train-the-trainer; competence circles to tailor intervention to address OHS/health/stress/work design (baseline data)	8 mo	Improved general health; increased MSD symptoms; greatest effects in home-care staff (vs. on-site staff)	5.5
Serxner et al., <sup>52</sup> 2001	Employees/large telecommunication co./United States (N = 1628)	Short-term disability days	Coordination HP-OHS; comprehensive program content	Intervention included: OHS, ergonomics; fitness center; weight management; smoking cessation; counseling (control: nonparticipants)	2 y	Control STD days increased by 15% during follow-up; participants decreased by 5%, $F = 6.64$ , $p < 0.01$	5.0
Sorensen et al., <sup>35</sup> 1996	Employees/24 manufacturing worksites/United States (N = 2658)	Participation in intervention programs	Comprehensive program content; coordinated management and employee strategies; coordination HP-OHS	Intervention: integrated governance and program planning; environmental changes; education (12 control worksites)	2 y	Less participation (nutrition) men (OR = 0.44); blue collar (OR = 0.66); higher participation when integrated with health protection (OR = 1.58); and perceived positive employer changes to reduce exposures (OR = 1.54)	7.5
Sorensen et al., <sup>58</sup> 1998	Employees/24 manufacturing worksites/United States (N = 2658)	Nutritional intake; smoking cessation	Coordinated management and employee strategies; coordination HP-OHS	Intervention: integrated governance and program planning; environmental changes; education (12 control worksites)	2 y	Reduced fat intake 2.2% ( $p < 0.01$ ); increased fiber intake 12% ( $p = 0.01$ ); increase fruit/vegetable (+4% vs. +9%; $p = 0.04$ ); no significant effect smoking cessation	7.5
Sorenson et al., <sup>34</sup> 2005	Employees/26 small business manufacturing worksites/United States (N = 974)	Nutrition; vitamin use; physical activity	Comprehensive program content; coordinated management and employee strategies; coordination HP-OHS	Intervention: individual; manager and environmental change; reducing occupational hazards (smoking cessation program)	18 mo	No overall effects except multivitamin use; effects higher for workers (cf. managers) for fruit/vegetable intake (-5.5 vs. 7.5); for physical activity (-2.0 cf. 7.1)	6.5
Hunt et al., <sup>55</sup> 2007	Employees/26 small business manufacturing worksites/United States (N = 1408)	HP program awareness; HP program participation	Coordinated management and employee strategies; coordination HP-OHS; process for training/accountability	Intervention: individual; manager and environmental change; reducing occupational hazards (smoking cessation program)	2 mo	58% (cf. 3.9% control) health program awareness; 74% (cf. 29% in control sites) participation	6.5
Talvi et al., <sup>42</sup> 1999	Employees/2 oil refineries/United States (N = 885)	Diet; exercise; physical activity; MSDs; obesity; blood pressure; smoking	Coordination HP-OHS	Intervention site: HP assessment, counseling, and referral (assessment, written info only)	3 y	Improved physical activity (OR = 1.94) but not other outcomes	4.5
Tveito and Eriksen, <sup>37</sup> 2009	Female nurses/nursing home/Norway (N = 40)	Sick leave; HRQoL; coping; job quality; subjective health ratings	Comprehensive program content; coordination HP-OHS	Intervention: physical exercise; stress management; health information; workplace assessment (waitlist control)	9 mo	No effects primary/secondary outcomes except subjective health ratings improved	6.0
Verweij et al., <sup>38</sup> 2012	"At risk" employees/medium to large enterprises/Netherlands (N = 523)	Physical activity; sedentary behavior; diet and weight	Comprehensive program content; coordination HP-OHS	Intervention: care according to new integrated OH practice guidelines (usual care)	6 mo	No effect weight or physical activity except for those with highest BMI; decreased sedentary behavior; increased fruit intake	8.5

**Table 4, Continued**  
**Summary Characteristics and Results of Studies Reporting on Integrated Interventions (All Comparison Groups; n = 27)\***

Source	Occupation/ Workplace/ Country (No.)	Target of Intervention	Indicators of Integrated Approaches†	Intervention (Control or Comparison Group)	Follow- Up	Effectiveness Against Targeted Outcomes	Quality Score‡
Verweij et al., <sup>59</sup> 2011	Occupational care physicians (N = 7), and employees (N = 274)/medium to large enterprises/ Netherlands	Process evaluation	(As above)	(As above)	(As above)	Reach = 86%; attendance 4.4/5.0 sessions; satisfaction 7.6/10; fidelity mixed	6.5
Vuori et al., <sup>50</sup> 2012	Employees/17 organizations/ Finland (N = 718)	Depression, fatigue; work engagement; career self- efficacy	Coordination HP-OHS	Intervention: group training for career efficacy (written information only)	7 mo	Increased work engagement, mental resources, CME; reduced depression and intention to retire; no effect fatigue	8.0

\* HP indicates health promotion; OHS, occupational health and safety; MSD, musculoskeletal disorder; OR, odds ratio; RR, relative risk; HRQoL, health-related quality of life; BMI, body mass index; SME, small-medium enterprises; WC, worker's compensation; ROI, return on investment; STD, short-term disability; and CME, career management efficacy.

† Based on Sorensen et al.,<sup>5</sup> Indicators of Integrated Approaches (Table 2, p.S16).

‡ American College of Occupational and Environmental Medicine Practice Guidelines, Harris et al.<sup>26</sup>

provements on the study-specific environment assessment tool were found for the intense arm only.<sup>54</sup>

## CONCLUSIONS

Despite growing interest and momentum, empirical evidence about the effectiveness of integrated approaches to worker health, safety, and well-being has been slow to emerge. This study is one of the first studies to systematically review the extant scientific evidence about the effectiveness of workplace health and safety integration. Our focus here was on integrated approaches to health and safety protection in the workplace rather than on any particular health risk, or occupational exposure or outcome per se. Heterogeneity precluded formal analytic review; we synthesize findings from a range of study designs, across a broad range of health and safety outcomes assessed.

Most studies were of moderate (rather than high or low) quality, with some design and conduct limitations as classified by the ACOEM Practice Guidelines.<sup>26</sup> Further, most studies reported on intermediate or precursor outcomes, rather than the “harder” outcomes of mortality or costs. This reflects that results from this body of evidence are encouraging yet still

emerging, and research design has, for the most part, yet to reach “gold standard.” Given these constraints, it is worth interpreting the results of this review with some caution.

Our first aim was to review the effectiveness of integrated approaches against targeted intervention outcomes, which we classified into five broad categories, of which physical health and health behaviors were the most common (55% of studies). Of these, interventions (and thus primary outcomes) varied widely, particularly in the degree to which organizational-level or environmental-level change was targeted. Most studies reported effects in favor of the intervention (n = 9),<sup>30,31,33–38,54</sup> with fewer reporting mixed effects (n = 3)<sup>29,39,40</sup> or no effects (n = 2).<sup>41,42</sup> Overall, this yields promising effectiveness in improving worker health behaviors. With one exception,<sup>30</sup> these studies were among the moderate- to high-quality studies (score range, 4–8.5), suggesting some confidence in attributing the positive effects to the intervention.

Notably, findings indicate that worker engagement is heightened when personal health behavior interventions are delivered in a context of occupational safety and organizational responsibility.<sup>29–31,33,36,37,55</sup> This suggests an important pathway via which integrated interventions can deliver

improved health outcomes, evidenced in the heightened reach and effectiveness that several of the interventions reported to sectors of the workforce that are normally hard to reach in HP interventions—blue-collar workers or home care nurses, for example.<sup>36,51,53</sup>

Integrated interventions targeting injury prevention and safety have to date focused on the prevention, treatment, and management of MSDs. Current evidence was equivocal, and the studies were of low quality. Two reported a decrease in the prevalence of MSDs,<sup>27,44</sup> one reported an increase,<sup>43</sup> and one reported no significant effects on incidence.<sup>45</sup> The study reporting the most widespread changes in favor of the intervention was also that which implemented substantive “upstream” organizational change to support individual behavior change.<sup>44</sup> Although individual behavior change via new policies, practices, and tailored information and assessment was included in two further interventions,<sup>27,43</sup> these reported limited or few intervention effects. Over and above the latter two, the Nelson intervention engaged the organization not only as a support for individual behavior change, but also as a target of intervention itself, and a means of embedding, implementing, and sustaining strategies for injury prevention.<sup>56</sup> Overall, however, this



**Table 5**  
**Summary Characteristics and Results of Studies Comparing Standard to Integrated Interventions (n = 4)\***

Source	Occupation/ Workplace/ Country (No.)	Risk Category (i.e., Aim or Target of Intervention)	Criteria for Inclusion†	Intervention (Control or Comparison Group)	Follow- Up	Effectiveness Against Targeted Outcomes	Quality Score‡
Goetzel et al., <sup>32</sup> 2010	White-collar/blue-collar employees/ manufacturing co./United States (2431)	Obesity prevalence	Organizational leadership and commitment; coordination HP- OHS	Moderate (n = 4 sites): environmental prompts, point-of- choice messaging; intensive (n = 5 sites): specific manager engagement; organizational goal setting; leadership training and accountability; goal-setting rewards (3 sites usual HP)	2 y	Overall weight reduction in intensive group; no effect on proportion overweight, obese; improvements in biometrics; no behavioral change effects	7.0
DeJoy et al., <sup>54</sup> 2012	White-collar/blue-collar employees/ manufacturing co./United States (9 sites)	Process evaluation (implementation, fidelity); dose- related effects	Organizational leadership and commitment; coordination HP- OHS	(As above)	4 y	Environmental improvements in high-intensity arm; employee awareness similar both intervention types	6.0
Sorensen et al., <sup>36</sup> 2002	Employees/15 manufacturing worksites/United States (7327)	Comparing HP with HP-OHS for smoking cessation; fruit and vegetable intake	Coordination HP- OHS; coordinated management, employee engagement; comprehensive program content	HP-only arm: nutrition, tobacco use HP-OHS arm: nutrition, tobacco use integrated with health protection programs	2 y	No effects smoking, nutrition total sample; blue- collar workers' smoking cessation quit higher in HP- OHS arm (11.8% vs. 5.9%, <i>p</i> = 0.04)	7.5
Hunt et al., <sup>53</sup> 2005	Employees/15 manufacturing worksites/United States (7327)	Comparing HP with HP-OHS for smoking cessation; fruit and vegetable intake	(As above)	HP-only arm: nutrition, tobacco use HP-OHS arm: nutrition, tobacco use integrated with health protection programs	2 y	No differences in implementation; higher reach, awareness and participation in HP-OHS arm	7.5

\* HP indicates health promotion; and OHS, occupational health and safety.

† Based on Sorensen et al.<sup>5</sup> Indicators of Integrated Approaches (Table 2, p. S16).

‡ American College of Occupational and Environmental Medicine Practice Guidelines, Harris et al.<sup>26</sup>

evidence is in the early stages and relied on single-group design, precluding firm causal interpretation about effectiveness of integrated interventions in targeting safety and injury prevention.

Organizational-level changes are valid indicators of the effectiveness of integrated approaches,<sup>5</sup> and three studies (n = 3) assessed organizational health and safety management. Overall, studies reported improvements in

areas of health and safety systems and delivery that reflected the intervention content, but not other targeted outcomes.<sup>46–48</sup> Intervention effects appeared to cluster around the specific organizational elements targeted in

intervention content, rather than general perceived benefits across functions. It may be that longer follow-up intervals may detect more distal effects on organizations over time. Or it may be that a more comprehensive focus on organizational development is needed if the desired improvement is at the level of organizational functioning. Interventions that do not specify the integration and delivery of HP, safety protection, or medical care and services, for example, are unlikely to deliver comprehensive successes across all organizational functions.

Promising effects on several indicators of the psychosocial work environment, including improved job quality,<sup>39</sup> reduced stress,<sup>49</sup> and reduced symptoms of depression,<sup>41,50</sup> particularly for those reporting baseline depression, were reported, although not consistently.<sup>37,51</sup> The quality of these studies ranged from moderate to high (score range, 4–8), again suggesting a degree of confidence that effects were attributable to the interventions.

Of the nine studies reporting on various cost-related outcomes, five studies reported favorable effects on absenteeism, leave usage, or short-term disability days. The cost avoidance and protection of productivity indicated in these savings per employee are notable, particularly because four of these studies were of sufficient design quality to allow for causal interpretation.<sup>28,39,41,52</sup> However, four studies of low to moderate quality reported few or no effects on cost outcomes.<sup>31,37,43,45</sup> Overall, although some promising evidence exists, the weight of evidence makes it difficult to draw firm conclusions about the cost savings or efficiencies of integrated approaches. Plausibly, integrated approaches streamline organizational functions, thereby reducing intervention costs. However, the studies that compared standard to integrated approaches (Table 5) did not report on costs savings, so it is not possible to conclude whether this is the case.

Our second aim was to review studies where an integrated intervention had been compared with a more traditional, or “health promotion only” approach. This aim allows us to draw some early conclusions about the relative strength and efficacy to inte-

grated approaches where all other factors influencing study outcomes (study design, setting, sampling, measures, follow-up period) are held constant. Two studies (four papers) addressed this aim. Sorensen et al.<sup>36</sup> and Hunt et al.<sup>53</sup> found higher participation in the “intense” (integrated) arm compared with the “moderate” arm, concluding that for workers who perceive that their exposure to occupational hazards is being addressed at the organizational level (intense arm), willingness to engage in HP is increased. Blue-collar employees in the intense intervention arm had a near-double smoking cessation rate compared with those in the moderate arm. However, in the second intervention comparing HP with an integrated approach, no intensity effects were found against most outcomes, with the exception of the worksite observational environmental assessment, in favor of the integrated intervention.<sup>32,54</sup> Further research in this vein is required.

We acknowledge some limitations to our approach. Our study criteria were premised on a definition of “integrated approaches” derived from consensus literature. However, we may have excluded studies evaluating an integrated approach, but with insufficient detail in the published paper to establish eligibility. Our search was not exclusive to specific outcomes. Targeted searches pertaining to particular health conditions may have yielded more studies than our search strategy revealed. Our approach, although it precludes consideration or comparison of effectiveness against particular outcomes of interest between multiple studies, yields an update and overview of the effectiveness of integrated interventions presented in the scientific literature to date.

There are also some limitations to the body of literature. Although the quality of studies was assessed, significant biases are likely in the literature. Few studies reported on blinding and concealment, for example, and the reporting of other methodologic details (attrition, compliance, controlling analyses) were mixed. Incomplete information by which to comprehensively assess studies and their bias is a notable limitation. Finally, some key pathways to integrated approaches to

occupational health were not represented in the current literature. With few exceptions,<sup>31,38,42</sup> the integration with on-site medical management or physician care was not widely considered or reported. With the exception of reports of process evaluations, sufficient details about the organizational management, integration of systems and service delivery, and staff expertise were not reported. Understanding and evidence about the pathways and mechanisms via which integrated approaches are effective is therefore limited.

As the body of evidence grows, meta-analytic analyses ascertaining the effect of integrated interventions in targeting specific health outcomes will be possible. This will allow for comparison with more traditional approaches and for more robust conclusions about the efficacy and effectiveness of integrated approaches. Beyond this, future research needs to include the development and implementation of assessments of the type, nature, and degree of “integration” at the organizational level.<sup>12,57</sup> Future efforts will be improved by the recent publication of standard indicators and metrics to assess this.<sup>5,13</sup>

Integrated approaches have been posed as comprehensive, efficient solutions to complex issues. The evidence summarized here provides some early support for this, showing promising effectiveness particularly for individual employee physical and mental health benefits. Notably, integrated approaches were effective in accessing sectors of the workforce engaged in occupations associated with a high risk of accident or injury, with the least likelihood of engaging in HP. Importantly, some robust support for cost savings and for the protection of productivity was reported, albeit not consistently, in rigorous process and effectiveness evaluations. Higher-level organizational benefits were less well assessed or evident in this review. Furthermore, it must be noted that most of the evidence was derived from medium to large enterprises. The applicability and efficacy of integrated approaches for small to medium enterprises need to be confirmed. Given the emerging nature of this evidence and the variety of intervention targets

included here, firm conclusions regarding comprehensive effectiveness of integrated approaches are premature. However, this review provides some support and increased confidence that continuing investment in, and evaluation of, integrated approaches is worthwhile.

## SO WHAT? Implications for Health Promotion Practitioners and Researchers

### What is already known on this topic?

Integrated approaches to occupational health, safety, and well-being have been conceptualized and theorized in the international scientific literature for approximately two decades. Despite this, empirical evidence describing the implementation or efficacy of integrated approaches to worker health, safety, and well-being is sparse. A review of the evidence is both warranted and timely.

### What does this article add?

This article is the first to assess the empirical evidence about integrated approaches to worker health, safety, and well-being using a systematic review protocol.

### What are the implications for health promotion practice or research?

Extant evidence provides support for the integrated management of workplace health promotion and occupational safety, particularly for improving individual employee mental and physical health, with potential productivity and cost savings. Continuing investment in, and evaluation of, integrated approaches in a range of settings and organizations are warranted.

### Acknowledgments

The authors have no conflicts of interest to declare. The authors thank the Victorian Workcover Authority (formerly WorkSafe Victoria) for its review and comment on a draft of this paper. The authors acknowledge funding support from the Institute for Safety, Compensation and Recovery Research, Monash University, Melbourne, Australia. A.C. was additionally supported through the Roberta Holmes Transition to Contemporary Parenthood Program, Judith Lumley Centre.

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