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Health Promotion and Chronic Disease Prevention at the Workplace

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Abstract

The concept of workplace safety and health has focused largely on preventing accidents and on minimizing hazardous exposures. However, because workers spend a substantial part of their waking hours at the workplace, the potential to influence the health of a large proportion of the world's population through the workplace is enormous. The opportunities to carry out health promotion and chronic disease prevention activities at the workplace are countless, including (*a*) health screening; (*b*) tobacco cessation activities; (*c*) the promotion of healthy food choices and weight loss; (*d*) active breaks with physical exercise in terms of microexercise, enhancement of infrastructure to stimulate physical activity, and organization of work tasks to facilitate incidental physical activity; and (*e*) routine vaccinations. This review discusses the key factors necessary to implement health promotion and chronic disease prevention programs at the workplace (SWOLE model) and discusses the different foci and possibilities with respect to the differing nature of work for the blue- versus white-collar workforce.

INTRODUCTION

The journey toward workplace health promotion has a long and important history. In brief, the work environment and workplace safety have undergone significant changes during the last few centuries, driven by industrialization, technological advancements, labor unions, and legislation. During the Industrial Revolution, which spanned the eighteenth and nineteenth centuries, the shift from agriculture to industrialization marked the beginning of profound changes in work environments. This era saw the rise of factories and urban centers, which were often characterized by hazardous working conditions, extended working hours, and the exploitation of child labor (59). Throughout the nineteenth and twentieth centuries, labor unions emerged to advocate for workers' rights, pushing for better wages, reasonable working hours, and improved working conditions. The establishment of labor unions led to the negotiation of collective bargaining agreements, setting the stage for workplace safety regulations (56). In the nineteenth century and throughout the twentieth century, governments began implementing laws and regulations to protect workers and ensure safer work environments. Classical examples include the 1833 Factory Act in the United Kingdom (127), the Fair Labor Standards Act of 1938 in the United States (128), and the establishment of organizations such as the Occupational Safety and Health Administration (OSHA) of the United States and the European Agency for Safety and Health at Work (EU-OSHA) of the European Union. During the twentieth and twenty-first centuries, technology has played a crucial role in improving workplace safety, e.g., in terms of personal protective equipment, monitoring and control systems, and automation (80). In the late twentieth century and into the twenty-first century, the shift toward knowledge-based industries dominated by digital technologies led to the rise of numerous white-collar jobs. From a health perspective, these jobs are often sedentary with long periods of physical inactivity (32). At the other end of the physical activity spectrum, many people are still employed today in blue-collar jobs with high physical work demands, although technological advancements, such as technical lifting devices and exoskeletons, have reduced the physical burden of the job (39).

Although work environments and workplace safety have experienced significant improvements over the past centuries, contemporary challenges and opportunities continue to emerge. The prevalence of lifestyle diseases related to physical inactivity and unhealthy diets, such as diabetes and obesity, has steadily increased (89). In addition, in spite of advances in ergonomic factors in the work environment, a considerable number of white- and blue-collar workers still suffer from chronic musculoskeletal pain. In fact, low-back pain remains the global leading cause of years lived with disability (29). In response to these issues, occupational health professionals and researchers have sought health promotion initiatives that go beyond traditional efforts to prevent accidents and hazardous exposures at the workplace. Since the late twentieth century, workplace health promotion has matured into a distinct field within occupational safety and health research (43, 44), closely intertwined with the conceptualization of a broader health promotion mission as delineated in the Ottawa Charter for Health Promotion by the World Health Organization (WHO) in 1986. This process has reconceptualized health, transcending the negative connotation defined as merely the absence of illness, to encompass the integration of physical, mental, and social well-being.

The International Labor Organization estimates that 56% of the worlds' working-age population were employed in 2023 (61). Because workers spend a substantial proportion of their waking hours at the workplace, the potential to influence the health of a large proportion of the world's population through the workplace is enormous. Numerous opportunities exist for health promotion and chronic disease prevention initiatives in the workplace, including (*a*) health screening, (*b*) tobacco cessation activities, (*c*) the promotion of healthy food choices and weight loss, (*d*) physical activity, and (*e*) routine vaccinations.

This review discusses the key factors necessary to implement effective health promotion and chronic disease prevention programs at the workplace and discusses the different foci and possibilities with respect to the differing nature of work for the blue- versus white-collar workforce. This review presents a critical appraisal of the significant, rather than the total, peer-reviewed literature in the field.

HEALTH SCREENING

Hypertension and diabetes are examples of serious noncommunicable diseases that can remain undetected in workers for years but have sudden consequences in terms of ischemic heart disease, stroke, and premature mortality (42). Back pain is an example of a highly bothersome noncommunicable musculoskeletal disorder that increases the risk of lost productivity and sickness absence in both blue- and white-collar workers (3). Health screening can be a useful starting point for identifying workers at risk for noncommunicable diseases and disorders.

Health screening is a targeted and systematic approach intended to identify diseases or preclinical conditions in individuals who perceive themselves to be generally healthy but are at risk of a specific health impairment (143). From a workplace perspective, health screening can also include identifying modifiable risk factors for sickness absence or loss of workability among workers. Thus, health screening at the workplace may identify workers who could benefit from early treatment or intervention through workplace health promotion and chronic disease prevention programs.

A systematic review from 2010 showed that workplace health screening leads to only slight, although positive, changes in health behaviors (114). Thus, health screening can serve as a starting point for workplace health promotion programs in (*a*) initiating the behavioral change process and (*b*) identifying the specific needs for the interventions outlined in the later sections of this article. Optimally, health screening should embrace all major elements of health, including cardiovascular and metabolic, musculoskeletal, mental, and social health (**Figure 1**).

In the sections below, workplace interventions are limited to those targeting cardiovascular, metabolic, and musculoskeletal health (including tobacco cessation, diet, and physical exercise), although these interventions can also have a positive spillover to mental and social health. With

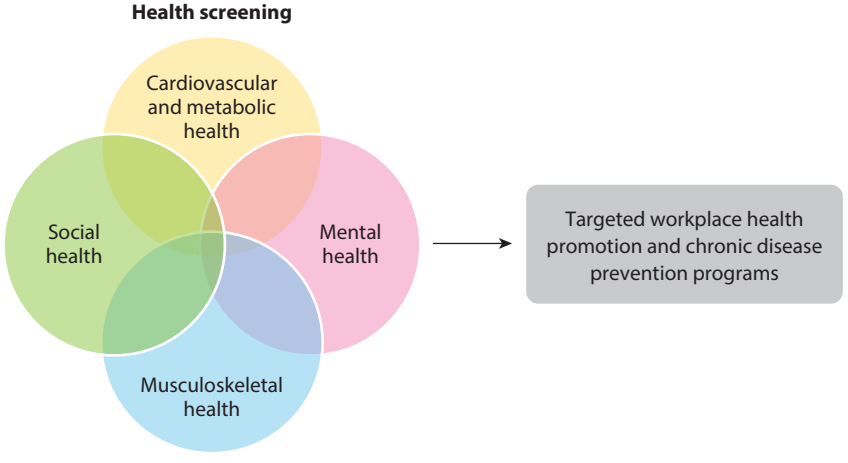

Figure 1

Four major components of health screening that can be used to better target workplace health promotion and chronic disease prevention programs.

the assistance of health professionals, the following four low-cost health screening elements are feasible to implement for the majority of workplaces.

Cardiovascular and Metabolic Health

The American Heart Association recommends seven modifiable elements related to cardiovascular and metabolic health (12):

1. Tobacco use evaluated from interview or questionnaire;
2. Body mass index (BMI) calculated from measured weight and height;
3. Level of physical activity evaluated from interview, questionnaire, or activity monitors;
4. Dietary status evaluated from interview or questionnaire;
5. Cholesterol measured with finger stick blood tests;
6. Blood pressure measured during resting conditions; and
7. Fasting plasma glucose measured with finger stick blood tests.

Musculoskeletal Health

Considering the high prevalence and cost of musculoskeletal health problems, e.g., back pain (29, 48), including musculoskeletal health in a workplace health screening program can provide a better basis for targeting preventive strategies such as muscle strengthening programs for blue-collar workers (119), which will be discussed in more depth later in this article. Musculoskeletal health screening can include

1. Pain intensity and duration in different body regions from questionnaire or interview (8);
2. Physical demands of the job from questionnaire, interview, or workplace observations (8, 123); and
3. Muscle strength, e.g., measured using a handgrip dynamometer (85).

Mental Health

Considering the high prevalence and cost of mental health problems worldwide (48), including mental health in a workplace health screening program could be wise. A study from Finland found that mental health evaluation is often lacking in health screening programs (72). Simple screening tools can include, for example,

1. Depressive symptoms evaluated from interview or questionnaire (15);
2. Stress symptoms evaluated from interview or questionnaire (131); and
3. Vitality and mental health evaluated from interview or questionnaire (37).

Social Health

Social health in a workplace context refers to the quality of the workers' social connections and networks at the workplace, for example, having positive interactions with colleagues, feeling a sense of belonging and support, and having opportunities for meaningful social engagement. Workers experiencing good social relations with colleagues are more likely to adhere to other types of health promotion programs, e.g., physical exercise (5). Screening for social health is therefore an important, but often forgotten, part of workplace health promotion programs. Social health screening can for example include:

1. The quality of working relations within groups of workers, between groups of workers, and between workers and their leader, respectively, evaluated from questionnaire or interview (5, 33).

Health Literacy in Blue- Versus White-Collar Workers

Because participation in workplace health screening programs is usually optional, there may be differences in participation between different groups at the workplace. Workers' health literacy—i.e., the ability to find, understand, and use health-related information—plays a crucial role in the implementation of workplace health promotion programs. Education level, socioeconomic status, and workplace culture can contribute to varying levels of health literacy between blue- and white-collar workers. Understanding complex health information and navigating health care systems might be challenging for workers with less or no education, which can limit their willingness to participate in health screenings and workplace health promotion programs. Observational studies from Asia, Europe, and the United States have consistently found that level of education or socioeconomic position is linked with health literacy and health behaviors (17, 30, 46, 93, 99, 115). Health literacy is also an important mediator between education and health behaviors (46). Consequently, workplaces should prioritize effective communication strategies, ensuring that workers with limited or no education, often those in manual labor roles and with poor health, recognize the importance of participating in these programs. Workplaces should therefore tailor health promotion programs to the specific needs of blue-collar workers, focusing on clear communication, easily understandable health information, and culturally relevant interventions.

TOBACCO CESSATION

Tobacco use, especially smoking, is a major risk factor for cardiovascular and respiratory diseases, various cancers, reproductive health issues, oral health problems, and many other debilitating health conditions (91). The Global Burden of Disease Study estimated that smoking caused 8 million deaths and 200 million disability-adjusted life-years globally in 2019 (104). In 2020, 22.3% of the world's population aged 15 years and above were active users of some form of tobacco product (141). The Demographic and Health Surveys conducted between 2010 and 2019 in 49 low- and middle-income countries revealed the highest prevalence of tobacco use among the least educated and poorest men aged 15–49 years (11). Thus, blue-collar workplaces should be especially aware of this challenge. Due to the highly addictive nature of nicotine, tobacco users often struggle to quit on their own. The workplace can play an important supportive role in tobacco cessation (26), potentially preventing a range of chronic diseases. A combination of the following key elements are vital for successful implementation of and adherence to tobacco cessation interventions at the workplace.

Interventions Targeting Individual Workers

Effective workplace interventions targeting individual workers include counseling and nicotine replacement therapy.

Individual counseling. Workplace interventions demonstrate positive effects from individual counseling in terms of one-on-one support to workers who try to quit smoking (50, 51, 66, 73, 125). In these studies, health care professionals, such as doctors, nurses, or health educators, provided the counseling. Despite varying methods and lengths of counseling sessions, all interventions focused on offering personalized help for smoking cessation. Effective individual counseling methods included short advice sessions, longer motivational interviews, and supportive follow-up phone calls. The interventions included workers from different job groups such as those in manufacturing, factory workers, ambulance workers, construction workers, and mixed groups of workers. The results are therefore likely generalizable to both blue- and white-collar workers. Based on the

existing literature, investing in a health care professional to lead individual counseling is advisable, although this approach may not be realistic for workplaces with limited resources.

Nicotine replacement therapy. Workplace interventions demonstrate positive effects from providing workers with nicotine chewing gum or nicotine patches to support smoking cessation (69, 108, 120, 121). Given its simplicity and low cost, this type of intervention is likely to be generalizable to both blue- and white-collar workers.

Interventions Targeting Groups of Workers: Group Counseling

Workplace interventions show positive effects from group counseling, which consisted of behavioral interventions provided to groups of workers with the goal of smoking cessation or relapse prevention (53, 83, 86, 103, 110). In these studies, psychologists, ex-smokers, or other trained facilitators led the interventions. The specific intervention components included support meetings, competitions, and cognitive-behavioral strategies. Support meetings are valuable because workers can share experiences, challenges, and successes related to smoking cessation. These meetings offer an opportunity for workers to receive guidance, encouragement, and motivation from others on a similar journey. Some group counseling interventions have also involved ex-smokers who shared their personal experiences and effective strategies. Ex-smokers at the workplace can therefore serve as role models and provide inspiration for colleagues who are trying to quit smoking. Cognitive-behavioral strategies, led by a psychologist, can be effective in identifying and changing thoughts and behaviors that contribute to smoking. These strategies can help workers develop coping mechanisms to deal with cravings and triggers. From a cost perspective, workplaces with limited resources may prefer group counseling instead of individual counseling, as one therapist can lead sessions for several workers at a time.

Workplace Policies, Including Smoke-Free Policies

In recent years, smoking has become less socially acceptable, leading many workplaces to implement smoke-free policies, ranging from complete smoking bans during working hours to designated smoking areas in the workplace. In spite of methodological limitations such as a lack of randomization, several observational studies have evaluated smoke-free workplace policies and reported positive results in relation to smoking cessation and reduced secondhand smoke exposure (81, 82, 87, 124). However, many barriers to complying with smoke-free workplace policies still exist (75, 145), especially at blue-collar workplaces (11). At the individual level, lack of acceptance about the detrimental health effects of smoking, policy boundaries, and negative attitudes toward smoking cessation contribute to noncompliance (75, 145). In relation to the introduction of smoke-free policies, workplaces should ensure sufficient understanding of the health risks of smoking and secondhand smoke exposure. Organizational barriers involve weak implementation of smoking bans, lax measures and surveillance, and the provision of ashtrays, which signal tacit approval of smoking (145). The top management and work environment organization should take responsibility for appropriate measures to implement the smoke-free policy. The work environment organization within a company typically includes work environment representatives elected by the employees and a work supervisor appointed by the employer; however, practices may vary between countries and companies of different sizes.

HEALTHIER FOOD CHOICES AND WEIGHT LOSS

Globally in 2016, 1.9 billion adults were overweight, of which 650 million were obese, a statistic that has tripled from 1975 (57). Consuming excessive amounts of calories or an imbalanced diet

that has a high proportion of unhealthy ingredients is a major risk factor for obesity and, in consequence, a range of other health problems (23). A balanced diet, abundant in whole foods, lean protein, healthy fats, and a variety of fruits and vegetables, is crucial for optimal health, irrespective of occupation, age, sex, or country of residence (112).

In modern societies, the vast availability of unhealthy food often leads to unhealthy dietary choices (47). Contributing factors include convenience, affordability, marketing, taste preferences, and limited access to nutritious options (27). Several studies show that workplaces have the potential to significantly encourage and support healthy food choices among workers (22, 84, 92).

A combination of the following key elements are important when implementing initiatives for healthy food choices among workers: education and coaching, workplace policies, and nudging.

Education and Coaching

The classical approach of encouraging healthy food choices, often with the purpose of losing weight, is to educate and coach the individual to make better choices. Several randomized controlled trials involving workers from different occupations and countries have tested this approach (1, 31, 38, 65, 113). The studies included workers from corporate workplaces, mixed workplaces, health care workplaces, and fire departments. In general, the interventions were designed to be feasible and appealing for workers to participate in, often taking place during working hours. The programs used different educational and coaching methods, including group sessions, emails, and online tools, led by nurses and other professionals. All the interventions led to positive behavioral changes and weight loss among the participating workers. A secondary analysis of one of the trials found better results among workers with lower health literacy at baseline (65), making this type of intervention especially relevant for blue-collar workplaces.

Workplace Policies

Workplace policies about healthy food options typically include elements of restrictions, accessibility, and financial incentives, which can, to some extent, lead to the selection of healthy food choices among workers, although methodological limitations exist in many studies (22, 116). Nevertheless, some practical examples are worth mentioning. Workplaces can have a policy of restricting snacks and unhealthy food in cafeterias, replacing them with whole foods, a variety of fruits and vegetables, and food options containing lean protein and healthy fats. Knowledgeable cafeteria staff and the promotion of good habits are important factors for successful implementation of such policies at the workplace. A nonrandomized study in Denmark observed increased fruit and vegetable consumption among workers after cafeteria staff received eight hours training that included goal setting, strategy development, and implementation for the participating cafeterias (74). Furthermore, workplaces can have a policy of replacing unhealthy snacks and soft drinks in vending machines with healthier alternatives, such as nuts, dried fruits, whole-grain snacks, and water. A less restrictive policy can be to offer discounts or special deals on healthier food options, making them more financially attractive compared with less healthy alternatives. Collaborations with local restaurants or food vendors that offer healthy options may be a possibility to provide employees with discounts or special deals on nutritious meals.

Nudging

In contrast with restrictive workplace policies, nudging is a concept in behavioral economics and psychology that involves gently steering people toward making better decisions without restricting their freedom of choice. In a workplace context, nudging can be useful in steering workers

toward healthier food choices and can often be implemented with little cost for the workplaces. A large randomized trial involving 30 cafeterias at workplaces in the Netherlands implemented a combination of several different nudging strategies (healthier food options, smaller portions, free water, positioning of healthier products at eye level, cheaper combo deals, and altering of prices to favor healthier choices). While the results from this trial found increased sales of healthier meals, isolating the most impactful elements remains challenging due to the multifactorial nature of the intervention (130).

Other studies with simpler nudging strategies, which may be more feasible for workplaces to implement, also found positive results. For instance, a large randomized controlled workplace trial from England found a reduction in the total amount of calories purchased from the cafeteria per worker in response to reducing the caloric proportion of high-energy foods and implementing smaller plates to decrease portion sizes (105). Smaller studies with weaker methods have indicated similar results (58, 98). Using another approach, a long-term before-and-after study found that labeling food (green: healthy; yellow: less healthy; and red: unhealthy) and placing the healthy food at eye level resulted in sustained healthier food choices over two years among the workers (126).

PHYSICAL ACTIVITY

Insufficient physical activity is a major risk factor for a range of noncommunicable diseases, including coronary heart disease and diabetes, and is the fourth leading global cause of premature mortality (67, 76). The WHO recommends adults to be moderately and vigorously physically active for at least 150–300 and 75–150 min, respectively, throughout the week (140). In addition, the WHO recommends that adults perform muscle-strengthening activities twice a week and limit sedentary time. In 2016, 28% of the world's population was insufficiently physically active, with a prevalence twice as high in high- versus low-income countries (54). Drawing on historical data since the 1960s, the US workforce has experienced a decline in cardiorespiratory fitness, likely caused by decreased levels of physical activity and the obesity epidemic (25, 101). The workplace holds a major potential in supporting all four WHO recommendations in terms of moderate, vigorous, and strengthening activities, as well as limiting sedentary time.

Moderate-Intensity Aerobic Physical Activity

Implementing moderate activity in the workday is most relevant at office workplaces characterized by sedentary work, as blue-collar workers often walk close to 10,000 steps during the workday (34).

Walking. Brisk walking is an example of a simple, healthy, moderate-intensity activity. Engaging in 30 min of brisk walking immediately before or after the lunch break can attenuate the meal-induced insulin response and the associated drowsiness (45, 122), which may help maintain postlunch work performance and could even serve as an alternative to traditional seated meetings. Despite the simplicity, a randomized controlled trial from Denmark found a low uptake of walking meetings among office workers (36). Despite the simple nature of walking meetings, the study identified several barriers, including bad weather (Denmark!), the need to write or use a computer, and difficulties in walking and conversing in larger groups (36). A Spanish study in office workers found that time pressure and cultural norms were barriers for walking meetings (21). By contrast, a survey conducted among Australian workers found walking to be one of the preferred activities for workplace health promotion (60). The environment around the workplace also matters; an observational study from an urban community in the United States found that the conditions of

sidewalks, access to parks, and feeling safe in the area were important factors (111). Thus, the built environment around the workplace influences the possibilities for outdoor work-related activities. Overall, walking meetings may be most effective as one-on-one engagements where computer use is unnecessary and where the environment, cultural norms, and weather conditions are taken into consideration.

Active commuting. Cycling or other forms of active commuting to work can serve as a healthy way to incorporate moderate-to-vigorous exercise into workers' daily routines (100, 109). However, cultural and geographical factors influence the feasibility. For instance, Scandinavian and Northern European countries tend to have cycling lanes and utilize these active modes of transport. By contrast, this activity can be unfeasible in many parts of the United States where cycling lanes are less common (97), although subsidizing workers who choose active commuting instead of driving may increase the proportion of workers who walk to work (94). As cycling can be quite strenuous and thereby discourage some workers, an electrically assisted bicycle can be a good moderate-intensity alternative (13, 18).

Vigorous-Intensity Aerobic Physical Activity

Enhancing cardiorespiratory fitness through vigorous-intensity aerobic activities is important for both blue- and white-collar workers. For workers with physically demanding tasks, improving cardiorespiratory fitness makes the work feel less strenuous (70).

Planned physical exercise. Jogging, fast cycling, and soccer are examples of planned vigorous-intensity activities, i.e., physical exercise. Randomized controlled workplace interventions show positive effects on cardiorespiratory fitness of such interventions (14, 40, 70, 95). However, these activities are often time-consuming and require planning, changing clothes, and showering afterward, which may limit their generalizability.

Redesign of work tasks. A novel approach to increase physical activity at the workplace is to redesign the core work tasks to be more vigorous, i.e., increase heart rate sufficiently to enhance cardiorespiratory fitness, while maintaining work productivity and providing opportunities for recovery during the workday. Such interventions are being tested for industrial workers and childcare workers (77–79). For example, instead of merely observing the children, the childcare workers can engage in vigorous games and sports together with the children (79). While such work modifications may be possible only in certain jobs, the idea of redesigning work tasks in light of principles from exercise physiology holds an unexploited potential that future research studies should explore.

Muscle Strength Training

For strength training to be successfully implemented in a workplace context, it should be brief, simple, inclusive, engaging, and supported by the management (10, 24, 60, 132).

Microexercise. Microexercise refers to brief bouts of physical exercise, such as strength training for the neck, shoulder, and back using elastic resistance bands, performed for 10–20 min three times a week (7). The simplicity of microexercise eliminates the need for commuting, changing clothes, showering, or other time-consuming activities associated with exercise in a fitness center (107). Several randomized controlled workplace interventions have shown positive effects of microexercise, including a reduction in musculoskeletal pain (6, 41, 62, 117), an increase in muscle strength (6), improvement in vitality (4), and enhancement of social health in terms of

improved working relations within teams at the workplace (5). Additional benefits for workers with physically demanding tasks include reduced physical exertion during work and improved work ability, i.e., the heavy work tasks feel lighter as muscle strength improves (63, 64, 118). Systematic reviews have documented positive effects on musculoskeletal pain in both blue- and white-collar workers (119, 129). In addition, a cohort study following 70,000 workers for 2 years in a national register indicated that implementing microexercise during working hours in all workplaces could potentially prevent 13% of all long-term sickness absences in Denmark (7). A national campaign targeted to workplaces in Denmark was followed by increased uptake of microexercises in a representative sample of the general working population (2, 7). Thus, on the societal level, national campaigns may be a cost-effective way to encourage workplace health promotion.

Case example of microexercise. In 2016, the Municipality of Copenhagen, Denmark, mandated up to 35 min of physical exercise per week during regular working hours for workers in the elder-care sector, affecting ~6,500 employees across 42 care centers and 5 home care units. Individual departments were empowered to decide how to conduct these exercises based on their unique circumstances. Drawing on a pilot project carried out between 2013 and 2015, the financing of this large-scale initiative was justified by its potential to maintain a healthier, more productive workforce, reduce absenteeism, and enhance worker retention. The program is ongoing as of 2023. This case example underscores the critical role of strong decision-making at the top level of the organization in supporting long-term workplace health promotion initiatives that are win-win for the workplace as well as for the workers. In practice, workplaces might begin with smaller pilot projects before transitioning to full-scale programs, ensuring that such initiatives are adapted to the needs of specific job groups and different departments. Evaluations of these programs could include company records of sickness absence and productivity, as well as brief surveys regarding feasibility, job satisfaction, well-being, and perceived health.

Limiting Sedentary Time

Sedentary behavior is an independent risk factor for poor health (19, 96). While the three aforementioned types of physical activity can contribute to reducing sedentary time, additional strategies can be implemented at the workplace.

Multicomponent interventions. A systematic review focusing specifically on reducing sitting time among white-collar workers found that multicomponent interventions, including modifying the physical office environment in combination with behavioral interventions, reduced sitting time by almost 1.5 h per workday (32). This outcome demonstrates a large potential for reducing sitting time in the workplace by summing up many small intervention elements.

Environmental factors. Environmental elements promoting incidental physical activity to break up sedentary time include sit-stand desks (32), the built environment such as easy access to stairs and outside locations (55), and a culture of standing meetings (36).

Support from colleagues and managers. A qualitative review found that time pressure and social norms were barriers to the implementation of strategies to limit sitting time and that support from colleagues and managers were strong facilitators of achieving reduced sitting time in the workplace (55). A cluster analysis based on data from 70,000 workers suggested that a supportive work environment is possible in spite of time pressure (9).

ROUTINE VACCINATION

In addition to the noncommunicable diseases and disorders discussed in this article, communicable disease prevention is another activity that workplaces may consider. Communicable diseases are infectious diseases caused by pathogens such as bacteria and viruses that can be transmitted from one person to another or through vectors such as mosquitoes. These diseases are responsible for millions of deaths worldwide, particularly in low-income countries with limited access to health care services and preventive measures. Throughout history, vaccines have prevented—and continue to prevent—millions of premature deaths and chronic diseases from communicable diseases each year (28). Routine vaccines are those recommended for everyone, depending on country of residence, sex, age, and vaccine history (142). Even though routine vaccination coverage is relatively high on a global scale, e.g., above 80% for diphtheria, tetanus, and pertussis, coverage has plateaued over the last decade and even declined during the COVID-19 pandemic (102). While the majority of recommended routine vaccines concern infants and children, a number of routine vaccines are also relevant for adolescents and adults (90). Globally, the WHO recommends the hepatitis B vaccine in adolescence or adulthood for high-risk groups if not previously immunized (138); booster vaccines in adolescence for diphtheria (135), tetanus (137), and pertussis (134); the Rubella vaccine in adolescent girls and adult women of reproductive age if not previously vaccinated (139); and the human papillomavirus vaccine in adolescent girls (136). In addition, routine vaccine recommendations exist for certain regions and some high-risk populations.

Considering the relatively high efficacy and safety of most routine vaccines (49), public health initiatives should prioritize to reach full coverage. Workplace vaccination campaigns can support a broader public health strategy toward full routine vaccination coverage in adults (52), especially in blue-collar workers, workers with no or low levels of education, and immigrant workers, where coverage is usually lowest (71). Such strategies could mitigate socioeconomic inequalities in health. The majority of research studies in this area concern workplace vaccination campaigns for influenza and—in response to the recent pandemic—COVID-19, with an abundance of studies performed in high-risk zones such as health care workplaces.

A combination of the following key elements can support successful implementation of and adherence to workplace routine vaccination campaigns.

Information about Benefits

Vaccination campaigns should first inform workers about the benefits of vaccination before offering the vaccine to the workers (88). Promotional posters and flyers at the workplace, informational emails and social media networks are low-cost tools for supporting routine vaccination campaigns. They can raise awareness about vaccines, provide essential information, encourage participation, demonstrate the commitment of the workplace to workers' health, and enhance influence from coworkers.

Free On-Site Vaccination

An observational study among health care workers from China showed that workers receiving free on-site vaccinations were more likely to complete all necessary doses than were those receiving the first dose of a multidose vaccination outside the workplace (144). An observational study from the United States also showed that offering free on-site vaccinations was associated with higher coverage among health care workers (20). Although not randomized, these studies demonstrate the importance of free on-site programs to increase vaccine coverage for infectious diseases such as influenza, hepatitis B, and diphtheria, tetanus, and pertussis. While economic expenses may discourage some employers from providing free on-site vaccination, several studies have

demonstrated the cost-effectiveness of influenza vaccines in various settings and target groups (35). This knowledge can be an important motivational factor for employers to invest in free on-site routine vaccination for workers. On a broader scale, societies have a responsibility to inform employers about the potential cost-beneficial effects of routine vaccinations at the workplace.

Involvement of Health Professionals

Providing vaccinations involves adhering to strict requirements, including proper storage and handling of vaccines, trained personnel to administer the vaccine doses, and the maintenance of a safe and hygienic environment for the vaccination process. In addition, following guidelines for monitoring and reporting any adverse events following immunization is required. Vaccination campaigns conducted outside health care facilities therefore pose several challenges for employers, potentially leading to increased economic expenses (16). During the COVID-19 pandemic, a lot of misinformation, skepticism, and conspiracy theories surrounding vaccines floated around social media. Consequently, health professionals and, in particular, occupational physicians play a vital role in workplace vaccination campaigns (106). In addition to following the strict requirements, health professionals can contribute to increasing worker knowledge, clear up misconceptions, address hesitancy, and recognize health needs, which can be especially relevant in blue-collar workers and those with short or no education (68, 71).

CONCLUSION

Workplaces have a unique potential to support public health initiatives and combat global health issues by implementing a variety of health promotion strategies. These strategies should start with the implementation of health screenings to help identify workers at risk for noncommunicable diseases and disorders. Using simple methods such as interviews, questionnaires, finger stick blood tests, and blood pressure monitors, health professionals can promptly detect potential health issues. Early identification of at-risk workers allows for timely interventions through workplace health promotion and chronic disease prevention programs.

Promoting healthy food choices at the workplace can contribute to combating the global obesity epidemic. This type of activity can be accomplished through education and coaching of workers, implementing policies to restrict unhealthy options, making healthier alternatives more accessible, and using nudging techniques. Another major health issue, tobacco use, can also be addressed at the workplace. Workplaces can support tobacco cessation through individual or group counseling interventions, the provision of nicotine replacement therapy, and implementation of smoke-free policies. Workplaces can further support public health by promoting adherence to the WHO's physical activity guidelines among both blue- and white-collar workers. Workplaces and policy makers should prioritize creating environments that facilitate and promote physical activity, taking into account both the nature of the work and the cultural and societal factors that influence physical activity. Redesigning work tasks to be healthier while maintaining productivity is a promising new research field that may benefit certain occupations in the future. Microexercise in terms of simple and brief strength training sessions together with colleagues is especially effective for musculoskeletal health problems and is easy to implement at the workplace. Finally, workplaces can potentially play a vital role in increasing vaccination coverage among adults, particularly among groups where coverage is often lowest, such as blue-collar workers and immigrant workers. This initiative can be achieved through workplace vaccination campaigns that provide information about vaccination benefits, offer free on-site vaccination, and involve health professionals. Workplaces and public health authorities should collaborate to implement and promote these campaigns.

Figure 2

The SWOLE model considers important factors at different levels for workplace health promotion and chronic disease prevention programs to be truly effective on a broader scale. Abbreviation: SWOLE, society, workers, organization, leaders, environment.

In sum, the present article shows that involvement, engagement, and changes at several levels are necessary to effectively implement workplace health promotion and chronic disease prevention programs. These levels include **s**ociety, **w**orkers, **o**rganization, **l**eaders, and **e**nvironment (conceptualized in **Figure 2** as the SWOLE model).

FUTURE ISSUES

1. Technological advancements will likely impact global health. Self-monitoring devices, enhanced with artificial intelligence, will likely offer personalized real-time health data and individual counseling to workers. This advancement could enable workplaces to proactively target health promotion programs to individual workers and groups of workers.

2. In battling the global obesity pandemic, innovative obesity medications designed to regulate food cravings and limit caloric intake (133) may reinforce behavioral interventions at the workplace.
3. Broadening the range of vaccines offered and providing free vaccinations to all workers hold great potential to increase future routine vaccination coverage. This approach could also prove particularly effective during future pandemics.

DISCLOSURE STATEMENT

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