

APŽVALGINIS STRAIPSNIS

Preventing chronic disease risk factors: rationale and feasibility

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Summary. *Objective.* The majority of the mortality, morbidity, and disability in the United States and other developed countries is due to chronic diseases. These diseases could be prevented to a great extent with the elimination of four root causes: physical inactivity, poor nutrition, smoking, and hazardous drinking. The objective of this analysis was to determine whether efficacious risk factor prevention interventions exist and to examine the evidence that population-wide program implementation is justified.

Materials and methods. We conducted a literature search for meta-analyses and systematic reviews of trials that tested interventions to increase physical activity, improve nutrition, reduce smoking and exposure to environmental tobacco smoke, and reduce hazardous drinking.

Results. We found that appropriately designed interventions can produce behavioral change for the four behaviors. Effective interventions included tailored fact-to-face counseling, phone counseling, and computerized tailored feedback. Computer-based health behavior assessment with feedback and education was documented to be an effective method of determining behavior, assessing participant interest in behavior change and delivering interventions. Some programs have documented reduced health care costs associated with intervention.

Conclusions. Positive results to date suggest that further investments to improve the effectiveness and efficiency of chronic disease risk factor prevention programs are warranted. Wide-spread implementation of these programs could have a significant impact on chronic disease incidence rates and costs of health care.

Introduction

In the second half of the 20th century, chronic diseases emerged as the leading causes of death and disability in the United States and other developed countries. Six of the ten leading causes of death in the United States are chronic diseases: heart disease, cancer, stroke, chronic lower respiratory tract disease, diabetes, and Alzheimer disease (1, 2). Physical inactivity, poor nutrition, smoking, and hazardous drinking have been identified as root causes of these diseases. As estimated by McGinnis and Foege in 1990 (3) and Mokdad, in 2004 these four behaviors are responsible for more than one-third of all deaths in the United States (2). In 2004, the World Health Organization attributed at least one-third of the worldwide burden of disease to tobacco, alcohol, blood pressure, cholesterol, and obesity (4). Differences in nutrition, physical activity, smoking, alcohol

consumption, and body weight have been associated with a range of life expectancy of 10 to 14 years (5, 6).

Despite the requirement for regular physical activity, if health is to be maintained, over half of US adults do not engage in physical activity at levels consistent with public health recommendations, and nearly 25% of the US population is completely sedentary (7). Although it has been calculated that death rates in men and women can be expected to decrease by 16 and 9%, respectively, by the adoption of desirable dietary behaviors, poor nutrition continues to increase rapidly as a cause death (8). The adverse health effects from cigarette smoking account for an estimated 438 000 deaths, or nearly 1 of every 5 deaths, each year in the United States (9, 10). More deaths are caused each year by tobacco use than by human immunodeficiency virus (HIV), illegal drug use, alcohol use, motor vehicle injuries, suicides, and

murders combined. As of 2004, the list of diseases caused by smoking included abdominal aortic aneurysm, acute myeloid leukemia, cataracts, pneumonia, periodontitis, cancers, chronic lung diseases, coronary heart and cardiovascular diseases, as well as reproductive effects and sudden infant death syndrome (11). Excessive or hazardous alcohol use, either in the form of heavy drinking (drinking more than two drinks per day on average for men or more than one drink per day on average for women), or binge drinking (drinking more than 4 drinks during a single occasion for men or more than 3 drinks during a single occasion for women), increases the risk of chronic disease such as liver disease, hypertension, and cardiovascular disease. Hazardous use of alcohol also increases the risk of both unintentional injuries and assault (12). Excessive alcohol use is the third leading lifestyle-related cause of death for people in the United States (12).

As early as 1985, it was recognized that the chronic diseases that are prevalent in developed societies result from a few root causes and that these root causes are preventable behaviors (13, 14). The World Health Organization has advocated action to prevent chronic disease risk factors, and the Institute for Clinical Systems Improvement in the United States has developed a guideline on the prevention of chronic disease risk factors (15, 16). This paper reviews the evidence that intervention can reduce the prevalence of physical inactivity, poor nutrition, smoking, and hazardous drinking. It also describes some of the considerations that might be taken into account when designing an intervention system that would have broad reach in a population with an adequate return on the required financial investment. Finally, it cites the evidence that interventions can reduce the cost of health care.

Material and methods

We searched PubMed, MEDLINE, Cochrane Library, PsychInfo, Web of Science, and EMBASE for relevant articles. We reference meta-analyses and systematic reviews published in peer-reviewed journals when they are available because the current criteria for the conduct of meta-analyses and systematic reviews, combined with the peer-review process, appear to yield accurate interpretations of scientific evidence in most cases. When neither meta-analyses nor published reviews are available, we reference papers describing original research.

Results

Physical activity

Three articles met criteria for being either meta-

analyses or systemic reviews of the efficacy of interventions to increase levels of physical activity. They provide strong evidence for at least a modest intervention effect. Kahn et al. performed a systemic review evaluating the efficacy of various interventions including community-wide campaigns, community social support interventions, school-based physical education, individually-adapted health behavior change programs, and enhanced access to places for physical activity combined with information (17). All of these interventions showed clear increases in physical activity levels. Proper et al. reviewed 26 controlled worksite intervention trials designed to promote physical activity. There was strong evidence for increases in exercise behavior as well as increases in energy expenditure (18). Vandelanotte et al. reviewed 15 website-delivered physical activity intervention studies and concluded that physical activity increased in eight trials (19).

Nutrition

Three articles met criteria for being either meta-analyses or systemic reviews of the efficacy of interventions to increase levels of fruit and vegetable consumption or reduce intake of saturated fat. Ammerman et al. reviewed 104 trials that promoted increased fruit and vegetable and decreased fat intake (20). The majority of these trials reported small but significant increases in fruits and vegetable consumption (average increase of 0.6 servings/day), and decreases in fat intake (7.3% average reduction in calories from fat). Pomerleau et al. reviewed 44 controlled trials for the United States Preventative Services Task Force. They found a small to moderate increase in fruit and vegetable intake (average increase of 0.3–0.8 servings per day) from self-help material and interactive communications (computer-tailored mailings, telephone counseling) when combined with brief provider advice (21). Lastly, a review that analyzed 9 randomized controlled trials of telephone-based nutrition counseling found a reduction in dietary fat (median effect size = 0.22) and an increase in fruit and vegetable intake consumption (median effect size = 0.41) (22).

Smoking

Because of the methodology that was used, the most valid reference on the efficacy of smoking interventions is the 2008 Clinical Practice Guideline sponsored by the public Public Health Service and partners (23). Based on the analysis of over 6000 articles, the expert panel concluded that while there is a strong dose-response between the intensity of treatment and

its effectiveness, even brief tobacco dependence treatments are effective. Medications and treatments involving person-to-person contact (via individual, group, or proactive telephone counseling) are both particularly effective, and combining the two classes of treatments markedly increases the effectiveness of intervention.

Alcohol

Three articles on interventions for hazardous drinking met our criteria as meta-analyses or systematic reviews of the evidence that intervention reduces rates of hazardous drinking. Bertholet et al. performed a meta-analysis of 19 randomized trials examining brief alcohol interventions at primary care facilities (24). Their results showed a reduction in alcohol consumption at both 6 and 12 months. The reduction was approximately 4 drinks per week. Kypri et al. performed a systematic review of 16 trials that used telephone-based, written correspondence, and/or computer-based interventions to reduce problem drinking (25). The results were mixed, but overall showed promise that these interventions could produce behavior change at a cost that would allow the program to reach a broad audience. Lastly, based on a systematic review of 12 randomized controlled trials evaluating behavioral counseling interventions for risky alcohol use (26), the United States Preventive Services Task Force concluded that good quality, brief, multi-contact behavioral counseling interventions in the primary care setting can reduce risky alcohol use.

Discussion

While we found evidence that intervention can change the behaviors that are risk factors for the development of chronic diseases, intervention programs alone are not sufficient for chronic disease prevention. The delivery of any technology requires the existence of both the technology itself and an effective technology delivery system.

Factors that are important to consider when designing a delivery system are the acceptability of the system to the stakeholders, the ability to deliver an adequate dose of the intervention, the ability to reach a large proportion of the population, and the ability to deliver the intervention at a cost that is acceptable to the intervention's sponsor.

Wasson and Solberg have described what they consider to be the critical components for a successful health services intervention (27):

Regarding the health care organization:

- measurable goals
- benefit to individuals
- incentives to providers
- effective improvement strategies that drive comprehensive system change
- senior leaders that visibly support the initiative
- Regarding community resources and policies:
- effective community support programs that encourage participation
- partnerships with community organizations that integrate services
- Regarding self-management:
- standardized assessments of knowledge, skill, confidence, supports, and barriers
- emphasis on the individual's active and central role in the intervention plan
- collaboration with the client in planning care
- Regarding decision support:
- evidence-based guidelines
- Regarding the design of the delivery system:
- defined roles and delegated tasks so that the process becomes a team effort
- reminder systems that assure follow-up
- proactive intervention

The authors also identify other issues that stakeholders must consider. Patients need knowledge, confidence, and skills to manage prevention. Physicians are typically the rate-limiting factor in medical care; most are primarily oriented toward diagnostic and therapeutic decision-making. Therefore, monitoring and education should be done by others. Although clinicians may not be conducting the risk factor prevention interventions, it is important that they reinforce the message.

Any time a new idea or technology is introduced, it is most likely to succeed if it is disseminated through pre-existing social networks (28, 29). In the case of preventing risk factors for chronic disease, the most attractive options for program delivery in the United States are employers and health plans. As alternatives, health departments, social service agencies, or voluntary organizations like religious organizations may be considered. In the United States, health plans are attractive intervention delivery systems because the majority of individuals are covered by some type of health insurance. For example, in Minnesota nearly 95% of individuals have either private or government insurance (30).

The work site is the most common site of social interaction in the United States, and when individuals have non-governmental health insurance, it is most likely that it is through their place of work. These

facts make the work site a good location for health promotion activities.

The Centers for Disease Control and Prevention (CDC) advocates a system that has comprehensive worksite health-promotion programs, health plans that cover preventive benefits, and effective health care systems (31). They have concluded that the most effective interventions in worksites will include:

- Screening, health risk appraisal (HRA) and referral to behavior change programs
- Environmental supports for behavior change
- Financial and other incentives for the individual who is the target of the intervention
- Corporate policies that support healthy incentives

Reaching the majority of the population is important not only for the purpose of achieving social justice; achieving impact with risk factor prevention interventions can only be achieved if a large proportion of the population is reached. Epidemiologic studies have demonstrated that only about 5% of the population is truly “low risk” and conversely, nearly all individuals could benefit from access to lifestyle assessment tools and assistance in behavior change (32). According to recent National Health and Nutrition Examination Survey data, among healthy adults aged 20 to 79 years, “low-risk,” individuals were responsible for approximately two-thirds of the overall population risk (33). In 1981, Geoffrey Rose defined this phenomenon as the “prevention paradox” (34). That is, a large number of people at small risk give rise to more cases of disease than a small number of people at high risk. Disease incidence can be reduced only by decreasing the mean level of risk factors among a large portion of the population. Conversely, when spread across the entire population, even modest intervention effects can have a large impact on disease incidence rates.

Although current technologies do not have the capability to eliminate the development of risk factors, past experience suggests that more successful delivery strategies can be developed. For example, the North Karelia Project was anticipated to reduce heart disease mortality by 70% based on *a priori* projections of decreasing risk factors (35). After 25 years of intervention, however, the achieved decrease in heart disease mortality was nearly 85% (36).

In the analysis of the development of new technologies, a few principles become clear. First, the early stages of technology development and intervention implementation may be only modestly successful while later stages are associated with both greater suc-

cess and greater efficiency. Second, as demonstrated by the North Karelia Project, the early estimates of potential intervention effect size may be too cautious, and the achieved effects could be even larger than originally anticipated.

Regardless of the vehicle chosen for delivery, there is evidence of a financial incentive for implementing risk reduction interventions. Matson et al. examined 19 worksite studies and 33 healthcare studies and concluded that intervention yields \$3 to \$6 return on each dollar invested over 2–5 years (31). The 13 048 participants who participated in a behavior change intervention saved an average of \$212 annually compared to non-participants. The greatest savings was seen in those who participated in both HRA and the intervention (37). An analysis of 1166 volunteers who received reimbursement for participating in a HRA, wellness activities, self-care materials and advice showed a significant reduction in absenteeism compared to non-participants (participants decreased days lost from 29.2 to 27.8, non-participants increased days off from 33.2 to 38.1), as well as cost savings after 2 years of the program (38).

One of the important aspects to successful behavioral change is having a social and physical environment that reinforces the intervention. For example, people tend to be more active in neighborhoods that have a higher residential density, a mixture of land uses, are perceived as safe, and have connected streets (39, 40). A reinforcing environment could help facilitate these interventions.

- Given the high percentage of sedentary workers, employees would benefit from activity encouragement.
- Incentives to bike/walk to work, providing exercise facilities, as well as time to take part in physical activity each day, and point of decision prompts have all been encouraged (39).
- Herman et al. concluded that a financial incentive for use of an online physical activity program reduced the participant’s risk of physical inactivity, life dissatisfaction, low perception of health, health risk status, smoking, and obesity rates (41).

Conclusion

Chronic disease accounts for 7 out of 10 deaths and affects the quality of life of 90 million Americans. There is strong evidence for at least modest intervention effects for each of the four predominant risk factors for chronic disease: physical inactivity, poor nutrition, smoking, and hazardous drinking. The interventions that are effective are diverse in nature, in-

cluded a health risk assessment (HRA), tailored face-to-face counseling, phone counseling, and computerized feedback. These findings suggest that, if effective program delivery systems are designed and implemented, programs to prevent the development

of risk factors for chronic disease could significantly reduce the chronic disease burden of Americans. Future research should aim at determining the critical components of a delivery system that can reach the majority of Americans and result in behavior change.

Lėtinių ligų rizikos veiksnių išvengimo pagrįstumas ir įgyvendinimas

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Raktažodžiai: lėtinių ligų rizikos veiksniai, prevencija, veiksmingumas, vykdymo priemonės.

Santrauka. Didžioji dalis mirštamumo, sergamumo ir nedarbingumo atvejų JAV ir kitose išsivysčiusiose šalyse yra sąlygojami lėtinių ligų. Daugelio šių ligų būtų galima išvengti pašalinus pagrindines keturias priežastis: mažą fizinį aktyvumą, blogą mitybą, rūkymą ir nesaikingą alkoholinių gėrimų vartojimą.

Apžvalgos tikslas. Nustatyti, ar egzistuoja veiksmingos rizikos veiksnių prevencijos priemonės ir patvirtinti įrodymus, kad programų įdiegimas yra pagrįstas.

Medžiaga ir metodai. Atlikome tyrimų, kurių metu buvo vertinamos mitybos gerinimo, rūkymo, aplinkos tabako dūmų poveikio ir nesaikingo alkoholinių gėrimų vartojimo mažinimo priemonės, metaanalizių ir sisteminių apžvalgų paiešką.

Rezultatai. Nustatėme, kad tinkamai suplanuotos prevencijos priemonės gali sąlygoti šių keturių elgsenos įpročių pokyčius. Veiksmingos prevencijos priemonės yra: individualios konsultacijos, konsultacijos telefonu ir grįžtamasis atsakas. Internetinis sveikatos elgsenos vertinimas kartu su grįžtamojo ryšio ir ugdymu patvirtintas kaip efektyvus metodas, nustatantis elgseną, vertinant dalyvio susidomėjimą elgsenos pokyčiais ir vykdant intervencijas. Kai kurių programų vykdymas sumažino sveikatos apsaugai skirtas išlaidas.

Išvados. Remiantis gautais rezultatais, galima teigti, kad tolimesnės pajėgos, mestos lėtinių ligų rizikos veiksnių prevencijos programų efektyvumui padidinti, yra pagrįstos. Šių programų įdiegimas galėtų reikšmingai sumažinti lėtinių ligų paplitimą ir sveikatos apsaugos išlaidas.

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