

## Web- and Computer-Based Smoking Cessation Programs Are Effective for Adult Smokers

Myung SK, McDonnell DD, Kazinets G, et al. Effects of Web- and computer-based smoking cessation programs: meta-analysis of randomized controlled trials. *Arch Intern Med* 2009;169:929–37.

### Study Overview

**Objective.** To evaluate the effects of Web- and computer-based smoking cessation programs.

**Design.** Meta-analysis.

**Setting and participants.** Two evaluators searched EMBASE, MEDLINE (PubMed), and the Cochrane Central Register of Controlled Trials for randomized controlled trials (RCTs) of Web- and computer-based smoking cessation interventions published up to August 2008. The language of publication was not limited to English. Bibliographies of relevant articles were also searched to identify additional studies. RCTs were included if they reported the effects of Web- and/or computer-based smoking cessation interventions and had  $\geq 3$  months of follow-up data. Smokeless tobacco users and trials involving quasi-experimental design were excluded. The 2 evaluators independently selected and reviewed eligible studies and achieved agreement through discussion. Relevant RCTs were judged to be low or high quality based on a validated scale evaluating for presence and type of randomization, blinding, placebo use, and follow-up adequacy.

**Main outcome measures.** Outcome measures were point prevalence of smoking abstinence, sustained abstinence, prolonged abstinence, and continuous abstinence. Subgroup analyses were performed in the following domains: study quality (low vs. high), type of intervention (Web vs.

computer), use of supplemental intervention (none, individual counseling, nicotine replacement, bupropion), age-group (adolescents vs. adults), follow-up period (3 months, 6–10 months, 12 months), type of abstinence measure (point prevalence vs. sustained), and loss to follow-up rate (low vs. high).

**Main results.** 287 relevant articles were identified, and 22 RCTs were selected from 1989 to 2008 for inclusion, which included 29,549 participants from 7 countries (16,050 enrolled in Web- or computer-based smoking cessation program groups and 13,499 enrolled in control groups). Follow-up ranged from 3 to 12 months, and 10 trials involved supplemental interventions (eg, counseling, classroom lessons, nicotine replacement, bupropion). Most trials (19/22) involved adults, and loss to follow-up was wide-ranging (5%–58%). Using a random-effects meta-analysis model of all 22 trials, Web- or computer-based programs had a significant effect on smoking cessation (relative risk [RR], 1.44 [95% confidence interval {CI}, 1.27–1.64]). Significant heterogeneity existed between the studies ( $I^2 = 60.7\%$ ), but there was no publication bias (Begg funnel plot was symmetric; Egger test,  $P$  for bias = 0.21). Similar results were found in the 9 trials using a Web-based intervention (RR, 1.40 [95% CI, 1.13–1.72]) and in the 13 trials using a computer-based intervention (RR, 1.48 [95% CI, 1.25–1.76]). The abstinence rate at 12-month follow-up was significantly higher in the Web or computer intervention group (9.9% [95% CI, 8.9%–10.9%]) than in

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the control group (5.7% [95% CI, 5.1%–6.3%]) as well as at 6-month follow-up (11.7% [95% CI, 10.5%–12.9%] vs. 7% [95% CI, 6.1%–8.0%], respectively); however, results were not significant at 3-month follow-up. Subgroup analyses revealed similar positive findings for different levels of study methodologic quality, stand-alone programs versus supplemental interventions, type of abstinence rates employed, loss to follow-up rates, and duration of follow-up period but not for adolescent populations (RR, 1.08 [95% CI, 0.59–1.98]). The influence analysis demonstrated that omitting any 1 study did not change the summary RR and 95% CI. A meta-regression analysis for subgroup analysis categories showed no significant findings.

**Conclusion.** This meta-analysis suggests that sufficient clinical evidence exists to support the use of Web- and computer-based smoking cessation programs for adult smokers but not for adolescent smokers.

### Commentary

Smoking is the leading cause of preventable disease and premature death both in the United States and worldwide. An estimated 5.4 million premature deaths due to smoking occur worldwide each year [1], with 440,000 of these deaths in the United States alone. Although up to 70% of smokers want to quit, only 2% to 3% a year are able to [2]. Recommended smoking cessation strategies in the 2008 U.S. Public Health Service clinical practice guidelines for treating tobacco use and dependence include brief health provider-initiated advice; individual, group, and telephone counseling; and numerous effective medications [3]. Increasing interest exists in Web- and computer-assisted models of cessation given their potential scalability, reduced staffing requirements, and the rapid growth in internet usage around the world (up to 1.6 billion users as of 2008 [4]). To date, some studies have found that computer- or Web-based smoking cessation programs are effective, while others have not.

In this meta-analysis, Myung et al sought to evaluate whether Web- and computer-based smoking cessation programs improve smoking cessation rates. Web- and computer-based programs increased the odds of smoking cessation by approximately 50% compared with control groups. The 6- and 12-month abstinence rates were significantly higher as well (11.7% and 9.9%, respectively). To put this into perspective, these abstinence rates are similar to individual in-person or telephone counseling interventions [5] but somewhat less than nicotine replacement or other smoking cessation medications [3]. In addition, the authors found that Web- and computer-based programs only showed an effect among adults, not adolescents. This finding could be due to the small number of heterogeneous studies that focused on adolescents. However, past reviews of these interventions in

adolescents found similar null results [6]. Thus, it is possible that Web- and computer-based cessation programs paradoxically might not work in this population of highly Web-connected individuals.

A few key limitations deserve mention. First, a high degree of heterogeneity existed among the studies. However, the general trend was in the direction favoring the intervention, and the robustness of the findings among other RCT subgroups suggests that this finding is a real effect, at least among adults. Second, the authors restricted the analysis to smokers and did not include smokeless tobacco users. This narrow scope reflects the predominance of literature focused on smokers. Initial studies of Web-based intervention for smokeless tobacco suggest a benefit as well, although more research is needed [7]. In addition, a paucity of data existed regarding the socioeconomic and educational status of the trial participants. Given that tobacco use is highly influenced by these variables, future work should incorporate this information. Smoking cessation was by self-report status only and not biochemically verified with cotinine or carbon monoxide assays. However, recent specialty society consensus statements support the routine use of self-reported smoking status for trials of this nature [8]. Finally, overall generalizability remains an issue. These trials were conducted among technically literate participants in North America, northern Europe, and Australia. How these results might be translated to lower resource, less computer-literate populations in the developing world, where the majority of the tobacco burden of disease occurs, remains to be seen.

### Applications for Clinical Practice

Web- and computer-based interventions appear to be a beneficial means of promoting smoking cessation. These interventions are at least as effective as individual counseling and deserve promulgation and promotion as systems-based approaches to treating tobacco use as a chronic disease are developed. Future research needs to focus on improving interventions targeted at adolescents and testing these interventions in the developing world.

—Review by Asaf Bitton, MD

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