

Summer 7-2014

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Recommended Citation

Keyser M, Goebel L. Update on adolescent tobacco cessation. *West Virginia Medical Journal*. May/June (Special CME Issue) 2014;110(4):46-52.

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Update on Adolescent Tobacco Cessation

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Abstract

Adolescent tobacco use is decreasing in West Virginia, a state which features the Not on Tobacco (NOT) and RAZE programs. This manuscript gives an overview of recent studies in adolescent tobacco cessation, what works and what doesn't. More research is needed to improve cessation rates in adolescents.

Introduction

The most recent results of the West Virginia Youth Tobacco Survey reveal a decrease in tobacco use among teens, with 18.6 percent of West Virginia high school students being smokers. This compares to the national rate of 23.3 percent.¹ While programs such as Not on Tobacco (NOT),² a teen cessation program, and RAZE,³ a teen led tobacco prevention program, have helped decrease the prevalence of tobacco use and increase tobacco prevention among West Virginia adolescents, more can be done. Research from the past several years examined a variety of intervention models to discover new

approaches to achieving tobacco cessation among adolescents.

Methods

Studies of tobacco cessation trials in adolescents were selected for review through a literature search of the PubMed database from the National Center for Biotechnology Information. The search terms used were "tobacco use cessation," "adolescent," and "United States." The results were filtered to include only randomized controlled trials conducted on humans or review articles that had been published in the previous ten years. Studies that examined participants over the age of 18 were excluded from review.

Studies were classified according to type and then compared according to size of participant population, follow up period, and results. The studies were grouped according to location and intervention mode, with the groups being school-based counseling, office or community-based interventions, pharmacotherapy approaches, and computerized interventions. One study assessing a primarily telephone-based intervention was also examined.

Results

School-Based

Six school-based studies were compared (Table 1). Two

studies examined the effect of group cessation programs,^{4,5} two studies used individual counseling sessions between the participating students and a school nurse,^{6,7} one study used classroom and school-wide cessation activities,⁸ and another used a combination of in-person behavioral and telephone interventions.⁹ Only half of the studies collected follow up data past 6 months and two thirds used biochemical validation of abstinence.

The most successful study compared the standard Not on Tobacco program (NOT) with a fitness component added (NOT + FIT), and a control brief intervention (BI).⁴ The NOT + FIT program had a larger effect on boys while girls responded better to the standard NOT program. However, at six months, the NOT + FIT program produced a significantly higher quit rate than BI for both boys and girls ($p=0.013$).

Both studies examining school nurse-administered individual counseling found increased short-term quit rates among teens receiving the intervention. In one study, 10.7% of teens who received counseling modeled on cognitive behavioral therapy (CBT) and the 5 A's model (Ask, Advise, Assess, Assist, Arrange) reported tobacco cessation that was biochemically verified at three months compared to 5.9% in the control condition.⁶

Objectives

After reading this manuscript the reader will be able to

1. Name two successful programs in West Virginia that have helped to decrease tobacco use among adolescents.
2. Know the most effective place to hold tobacco cessation interventions for adolescents.
3. Be aware of some pitfalls that may occur when performing research on adolescent tobacco cessation.

Table 1. School Based Interventions

Author	Study	Total # participants	Randomized	Treatment length	Follow up	Outcome measured	Biochemically Validated	Results	Notes
Pbert et al(4)	School Nurse CBT & 5 A's	1068	Cluster randomized by school	4 wks (4 weekly sessions)	3 & 12 months	Abstinence	Yes	3 Mo: 10.7% intervention vs 5.9% control (p=0.006) ; 12 Mo: NS	Intervention: calling it quits; more effective for boys (15.0% abstinence intervention; 4.9% control) (odds ratio [OR]: 1.90 [95% confidence interval (CI): 1.12–3.24])
Horn et al(5)	NOT + FIT vs NOT vs BI	233	Yes, by school	10 wks NOT & NOT + FIT, 1 session BI	3 & 6 months	Abstinence (self-report & 7d quit rt)	Yes, at 3 mo	3 mo, 13.75% NOT +FIT, 11.11% NOT, 4.76% BI, 7 day quit rate (CO validated), 6 mo, 31.25% NOT + FIT, 21.11% NOT, 15.87% BI	Added effect in boys: 7d quit rate 7.89% in NOT vs 23.68% in NOT + FIT; girls: 13.46% NOT, 4.76% NOT + FIT; NOT + FIT better than BI at 6 mo (p=.013)
Joffe et al(6)	NOT vs Kickin' Butts	407	Intervention randomized by school, students randomized to intervention v control WITHIN SCHOOL; Crossover study	10 wks, 2 lunchtime sessions/wk	1,3,6,12 months	Abstinence (30d)	Yes	Kickin Butts NS; self-report quit rate @ 1 mo higher among NOT than control; RR: 1.92 [95% confidence interval [CI]: 1.09 –3.40]	
Johnson et al(7)	Yearly cohort classroom activities + school-wide vs control	4763 (cohort)	Randomized controlled cohort study	Multimedia Continuous intervention	yearly (year 2, 3, 4,)	Prevalence of tobacco use	No	Higher 4-year increase in 30d smoking prevalence (8.2% v 4.3%, p=0.40) and 7d smoking prevalence (9.9% v 6.7%, p=0.36) in Control v intervention, but not statistically significant	
Pbert, Osganian et al(8)	School nurse counseling (5 A's) vs control	1148	Cluster randomized by school	4 weekly sessions	6 wks, 3 mo	Abstinence	No	Increased 6 wk quit rates (14.4% v 2.0%; OR= 8.4; 95% CI 3.7, 20.6) and 3 mo (21.9% v 4.2%; OR=6.4; 95% CI 3.4, 11.4) in intervention group (adjusted for school & confounders)	
Robinson et al(9)	Behavioral intervention Start to stop (STS) + brief telephone intervention monthly vs control	261(students were caught smoking)	Randomized by student	4 wks	12 mo	Abstinence	Yes	NS	2/3 assigned to tx condition. 6% cessation for each. High rate of falsification via self-report (self report of 26.3% STS vs 27.5% control, 43.9% of claims could be biochemically examined, w/ finding 50% falsification among those, 40% falsification STS vs 63% falsification control)

However, at 12 months, there were no significant differences in cessation rates between the two conditions. Another study by Pbert, et al. used an intervention based solely on the 5A's model.⁷ At six weeks post-intervention and 3 months follow up, a significant number of participants reported

tobacco cessation, compared to control participants, but this study lacked 12 month follow up results.

The two remaining school-based studies did not produce significant results. A four-year study of yearly anti-smoking classroom activities and school-wide messages among a student cohort found no statistically

significant differences in prevalence of tobacco use compared to control schools.⁸ A study of the Start to Stop behavioral intervention for students caught smoking at school administered by a trained health educator, with a follow up brief monthly telephone intervention also produced non-significant results,

Table 2. Community or office based Interventions

Author	Study	Total # participants	Randomized	Treatment length	Follow up	Outcome measured	Biochemically Validated	Results
Audrain-McGovern, et al(10)	Motivational Interviewing vs Structured Behavioral Advice	355	Multisite, RCT	12 wks	24 wks	7 day point prevalence	Yes	NS
Stoddard et al(11)	SMART intervention vs control	322	Yes, by store	12 mo	12 mo	Quit attempt	No	NS
Albrecht et al(12)	Pregnant teens, Teen Fresh Start(TFS) vs TFS-Buddy vs Usual Care(UC)	142	yes	8 wks	12 mo	Abstinence	Yes	Significant difference TFS-B v UC at 8 wks ($\beta = 1.316$, $p = .010$, 99% CI = 1.001, 13.893); NS at 12 mo.

Table 3. Pharmacotherapy

Author	Study	Total # participants	Randomized	Treatment length	Follow up	Outcome measured	Biochemically Validated	Results
Nicotine replacement (NRT)								
Rubenstein et al(14)	Counseling + Nicotine Nasal Spray vs Counseling alone	40	yes, open label	8 wks counseling + 6 wks NRT or 8 wks counseling	12 weeks	continuous Abstinence for at least 7 days	Yes	NS
Hanson et al(15)	Nicotine Patch (NP) plus Cognitive Behavioral Therapy plus Contingency Management (CM) vs placebo	100	yes	10 weeks	30 day	7 day point prev. and 30 day point prev.	Yes	NS
Roddy et al(16)	NP vs Placebo	98	yes	6 weeks	13 weeks	point preval	Yes	NS
Moolchan et al(17)	NP+gum in 4 groups of various combos with placebo patch or gum or both	120	yes	12 weeks	6 months	7 day point prevalence	Yes	NS
Bupropion								
Neiderhofer and Huber(18)	Bupropion 150mg vs placebo	22	yes	90 days	90 days	abstinence	Yes	55% bupropion vs 18% placebo $p = .0014$
Killen(19)	NP plus placebo vs NP plus bupropion SR 150mg	211	yes	8 weeks patch + 9 weeks bupropion or placebo	26 weeks	7 day point prevalence	Yes	NS
Muramoto et al(20)	Bupropion SR 150mg vs 300 mg vs placebo	312	yes	6 weeks	26 weeks	7 day point prevalence	Yes	NS
Gray et al(21)	Bupropion SR 300mg + CM vs Bupropion SR 300mg + no CM vs Placebo +CM vs placebo+no CM	134	yes	6 weeks	12 weeks	7 day point prevalence	Yes	NS

with a high rate of falsification of self-reported smoking cessation.⁹

Community studies

Community studies are summarized in Table 2. A community study of motivational interviewing versus brief advice at 3 month follow up showed no difference in abstinence.¹⁰ The

SMART (Smart Teens Against Risks of Tobacco) study tested a behavioral intervention in the work setting and showed no significant difference in quit attempts at 12 months follow up.¹¹ Only 78 of 322 participants completed both the initial and follow up surveys. The Teen Fresh Start plus buddy versus usual care for pregnant

adolescents showed a short-term benefit of the program, but no difference at one year follow up.¹²

Pharmacotherapy

There is limited data on pharmacotherapy for smoking cessation among adolescents. Table 3 shows results of randomized controlled trials of nicotine

Table 4. Computerized Interventions

Author	Study	Study Location	Total # participants	Randomized	Treatment length	Follow up	Outcome measured	Biochemically Validated	Results
Mermelstein and Turner(23)	NOT Plus (NOT + web adjunct) vs NOT	School	351	yes, by school	10 wks	3 mo	7 day point prevalence	No	End of Program: Marginally sig effect of NOT Plus (12.2% (n=22) vs 4.7% NOT (n=8) 7d quit p=0.06). 3 mo: Sig effect of NOT Plus 20.4% (n=37) vs NOT 10.6% (n=18) 7d quit p< .05. Using 30d quit criteria 7.1% NOT (12) and 13.8% NOT Plus (25)
Fritz et al(24)	CASCP vs control (zero intervention)	School	121	yes, by school	4 to 6 wks	1 mo	Abstinence	No	23% (12) of intervention pts reported cessation @ f/u vs 5% (3) control pts at f/u.
Prokhorov et al(25)	ASPIRE vs control (pamphlet)	School	1160, 62 smokers	yes, by school	5 weekly sessions + 2 "booster" sessions the following semester	18 mo	Smoking initiation, Abstinence	No	Initiation among baseline nonsmokers: 1.9% intervention vs. 5.8% control, p<.05. Self-report cessation not sig [60.7% intervention vs 61.8% control; OR= 1, 95% CI (0.3, 2.7)]
Patten et al(26)	Internet vs Brief Office Intervention (BOI)	Home internet vs in person office	139	yes	24 wks of access for internet tx, 4 weekly counseling sessions for BOI, interventions at 2 mo and 3 months	6 mo, 9 mo	30 day point prevalence	Yes	12% BOI vs 6% Internet cessation at 6 mo, but not statistically significant (p=0.217)

replacement and also for bupropion reviewed by Bailey et al.¹³ One of the studies showed significant abstinence short term, however it had only 22 participants. This study is additionally criticized because participants had to be abstinent on Nicotine Replacement Therapy (NRT) before randomization to bupropion or placebo.¹⁸ Compliance is poor with the nasal spray¹⁴ and gum¹⁷ and possibly also with twice a day pills like bupropion SR which is the only formulation of this drug approved for smoking cessation in adults.¹⁸ The bupropion study using a 300mg dose showed some short-term benefit.²⁰ The only study with varenicline was for tolerability and not cessation with over half the participants on the drug

having some side effects although most were mild and transient so authors felt this would not prohibit further study with this drug.²²

Computerized

Several of the studies examined involved computer-based interventions, the results of which are described in Table 4. Tobacco cessation rates were significantly higher than control in two studies. The first study examined the efficacy of an internet based addition to the standard NOT program, described as NOT Plus, versus NOT.²³ The addition of the internet component significantly increased short-term tobacco cessation rates, as quit rates of NOT Plus participants who reported tobacco cessation

for at least 7 days at the three month follow up were twice that of the control participants. The researchers found that teens who reported using the website were significantly more likely to have quit smoking at the end of the program (OR 2.81 95% CI: 1.02-7.71). Telephone calls to participants were also included in the program as adjunct interventions, but these were not associated with a significant improvement in tobacco cessation rates. In a study comparing the Computerized Adolescent Smoking Cessation Program (CASCP) to a non-intervention control, the one month quit rate among intervention participants was 23%, compared to 5% in the

control, however these rates were not biochemically validated.²⁴

One program, the ASPIRE CD-ROM, did not increase smoking cessation rates, but did have an effect on nonsmokers who were also recruited to the study, so it may have some benefit for smoking prevention.²⁵ At the 18 month follow up, 1.9% of teens who had reported themselves as nonsmokers at the beginning of the study had begun smoking, compared to 5.8% of baseline nonsmoking teens in the control group ($p < 0.05$).

Another study examined the impact of a home-based internet intervention compared to brief office visits.²⁶ More teens who were assigned to the brief office intervention had stopped smoking six months after the program (12%) compared to those assigned to the home internet cessation program (6%), but the difference was not statistically significant. In addition, only one third of the participants assigned to the internet program reported using the site after week three of the intervention.

Telephone

The one study that reviewed a motivational interviewing and cognitive behavioral skills training intervention exclusively administered by telephone involved 2151 smokers randomized by high school to the intervention or control and yielded an increase in short term smoking cessation rates among teens.²⁷ Over one third of the teens who received cessation counseling via telephone quit smoking one month after the end of the program compared to 28.7% of those in the control ($p = 0.015$). There was an almost significant treatment effect at six months, with a cessation rate of 21.8% among intervention participants compared to 17.8% of teens in the control condition ($p = 0.06$). The six month quit rate was statistically significant among teens reporting they were daily smokers ($p = 0.02$) as 10.1% of

them in the counseling group quit compared to 5.9% in the control group. In this study, however, about a third of participants failed to complete even one counseling call due to problems reaching the teen or obtaining parental consent, which may be a significant barrier to telephone counseling studies.

Discussion

Overall, group cessation programs designed for adolescents, such as NOT, appear to be the best method currently available to reduce teen tobacco use. Although modifications have been attempted to make such programs easier to implement by shortening sessions, they are most efficacious in their originally designed, hour-long meeting format. The NOT program was most successful when it was enhanced by additional components, such as the physical fitness module FIT or a complementary Internet site (NOT Plus).⁴ Although there exists very little data on cost effectiveness for cessation interventions in adolescents, there is some evidence that the NOT program is cost effective with a total cost in 2008 per school of only \$526.25.²⁸

Smoking cessation programs that target adolescents are easiest to implement in schools, since teens are required to spend much of their days there. This may explain why the school-based counseling interventions were overall more successful. However, with a scarcity of excess time during the school day, there could be a concern about finding enough time for such interventions. Conducting program meetings immediately after school could be a solution to maintaining high participation rates while preserving valuable instructional time, however transportation could be a barrier here.

Adolescent smoking cessation programs are fraught with limitations. School based cessation programs should be voluntary and not punitive, such as in the Start to Stop study,

which was offered as an alternative to a suspension and had falsely elevated self-reported cessation rates.⁹ When examining the efficacy of school-based interventions, it is important to assign all of the teens in a particular school to one study condition. Two studies which used the participant as the unit of randomization instead of the school reported concerns over their results. In the NOT vs. Kickin Butts study, authors postulated that the attrition they observed in the interventions could have been partially caused by a lack of interest by teens whose friends had been assigned to the control condition.⁵ In the CASC study, some participants attended the same school, and though they attended program sessions at different times, the researchers expressed concern that potential interaction between the groups could have influenced results.²⁴

In some situations, teenagers may not want their parents or school officials to know about their tobacco use, and therefore may be reluctant to take part in cessation treatment. Privacy is key to enrolling adolescent smokers. Both telephone and computer-based counseling are more private than group or in-person individual counseling. In addition, studies enrolling smokers and nonsmokers ensured that a teen's smoking status would not be revealed when their parents were contacted for consent. Though telephone counseling provides added privacy since it can be completed in virtually any location, it may not be the most feasible due to difficulties completing the calls.

The ASPIRE study enrolled all students in a class and was completed during class time, ensuring a captive audience.²⁵ Since this study decreased the percent of students becoming smokers it might be useful in smoking prevention. Given that this study, as well as the study by Patten et al.²⁶ examining the efficacy of unsupported access to a tobacco cessation website failed

to significantly increase tobacco cessation rates, it is apparent that adolescents are less likely to comply with a program if their participation is not regularly monitored.

One limitation of comparing studies using counseling is that they used different counseling techniques. For example, structured brief advice includes the 5 A's program and consists of the provider Asking every visit about tobacco use, Advising the patient in a clear and personalized manner to stop tobacco use, Assessing the patient's willingness to quit in the next thirty days, Assisting with cessation by using handouts or referral to the state's quitline, and Arranging follow up. It also includes the 5 R's for those who do not have the desire to quit: Relevance- tailoring the advice to each patient, Risks- discussing the risks of continuing smoking, Rewards- discussing the possible benefits to quitting, Roadblocks- identifying possible barriers to quitting, and Repetition- discussing smoking cessation at every patient

visit. Cognitive behavioral therapy is often used in conjunction with the 5 A's and for example helps patients think about their reasons for quitting, overcome barriers to quitting, and plan for what to do when situations arise that make them want to smoke. The brief intervention described in the study assessing NOT vs NOT + FIT was scripted and discussed general information about smoking cessation, including harmful effects, long-term consequences of tobacco, and possible withdrawal symptoms.⁴ Motivational interviewing techniques include expressing empathy, developing discrepancy between the behavior and the patient's goals and values, supporting self-efficacy and developing a formal plan for change.¹⁰

Not much is known about the efficacy of pharmacological approaches to adolescent smoking cessation because few studies have been performed. The medications tried in teens, nicotine replacement and bupropion, have been effective in adults with cessation rates at

one year in the 19-33% range.²⁹ Reporting cessation rates at one year follow up is the standard for smoking cessation studies, but most of the teen studies have poor results after even short term follow up. Compliance is an issue as illustrated by the study on nicotine nasal spray and also the bupropion study. Adolescents are even more likely to be noncompliant when faced with the negative side effects of medications, such as the burning and irritation associated with the nasal spray. Recruitment of students can be difficult since they have to reveal their smoking status to parents who must give consent. Additionally, those who have side effects from medications may discourage their friends from being participants.

This manuscript is not intended to be a complete review of the literature in this area since we limited our search to Pub Med and only randomized controlled trials and review articles performed in the past ten years. Rather it is intended



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as an update of a selection of the most recently published studies.

Conclusion

School based programs such as NOT have the greatest long-term success in adolescent smoking cessation. More research is needed to determine if additions to these programs can further decrease teen smoking rates. Future research in adolescent cessation should take into account the limitations described.

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CME Post-Test

20. NOT is the most successful tobacco cessation program in schools.

True False

21. The most successful format for tobacco cessation for adolescents is web based.

True False

22. Medication side effects often create a pitfall when doing tobacco cessation research with adolescents.

True False