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The effectiveness of an integrated multicomponent program for adolescent smoking cessation in Taiwan

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HIGHLIGHTS

- More beneficial results can be obtained when an intervention is designed based on a customized approach and evidence.
- An integrated intervention for student smokers at vocational high schools can effectively motivate them to quit smoking.
- The integrated intervention yielded tobacco abstinence at 4 months.
- The quitting rates obtained from objective cotinine tests were more conservative than those obtained from subjective self-reports.

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ABSTRACT

If adolescents do not receive appropriate assistance in quitting smoking, they are highly likely to become regular smokers when they enter adulthood. Thus, an effective smoking-cessation program is required. A program was designed based on both the smoking-cessation barriers reported by students and effective strategies derived from the literature. We assigned 143 student smokers from 6 vocational high schools to intervention ($n = 78$) and comparison groups ($n = 65$). Data were collected at the baseline, the end of the program, and 1- and 4-month follow-up time points. For the intervention group, the smoking-abstinence rates confirmed using the urine cotinine test were 22.73% at the end of the program and 20.75% at the 4-month follow-up point. Days smoked in the past month, number of cigarettes smoked per day, and the Fagerström Test for Nicotine Dependence score of the intervention group decreased at all of the time points. The group differences in these variables were statistically significant; the magnitude of effect sizes ranged from 0.44 to 0.95. Multicomponent programs addressing smoking-cessation barriers that students encounter can help adolescents quit smoking.

1. Introduction

Most smokers begin smoking during puberty. Colby, Tiffany, Shiffman, and Niaura (2000) concluded that most adolescent smokers consider themselves to be nicotine dependent and have difficulty quitting. In addition, adolescents at vocational schools exhibit a high risk of dependence (Colby, Tiffany, Shiffman, and Niaura, 2000). In one study, approximately 61% of adolescents who smoked daily attempted to quit smoking, but only 12% succeeded (Malarcher, Jones, Morris, Kann, and Buckley, 2009). A study revealed that 75% of teenage smokers continue to smoke into adulthood (Moolchan, Ernst, and Henningfield, 2000). If young people do not receive appropriate counseling to help them quit smoking, then they are highly likely to become regular smokers when they enter adulthood (Lantz, 2003). Thus, smoking prevention for adolescents is an effective means for controlling adulthood smoking. A study involving a cost-effective analysis of a school-based smoking cessation program yielded a satisfactory result, suggesting that the program was more cost effective than adult tobacco use cessation programs (Dino, Horn, Abdulkadri, Kalsekar, and Branstetter, 2008).

A higher smoking prevalence has been consistently observed among vocational school students than among general school students. The

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Global Youth Tobacco Survey (GYTS) in Taiwan revealed that 46.7% of vocational senior high school students had smoked at least one cigarette and 15.9% of them currently smoke cigarettes. In contrast to general senior high school students, the prevalence rates of senior vocational high school students who smoked and those currently smoking were 34.0% and 10.1%, respectively (Chen et al., 2008). The high smoking prevalence among vocational school students is consistent with that among students in the United States (de Moor et al., 1994; Sussman, Dent, and Lichtman, 2001), Europe (Ausems, Mesters, van Breukelen, and de Vries, 2004; Colby et al., 2000), and Thailand (Vichit-Vadakan, Aekplakorn, Tanyanont, and Poomkachar, 2004). Unlike high school students who typically prepare for tertiary education, students at vocational schools prepare for specific vocations. Johnston, O'Malley, Bachman, and Schulenberg (2010) suggested that students who do not plan to attend college are considerably more likely to be at a risk for substance use, including tobacco use, than college-bound students. Vocational students are likely to encounter smoking adults in a job-training environment outside of school, exposing them to a norm of smoking. Thus, an effective cessation program targeting the high-risk group of vocational school students is urgently required.

When a smoking-cessation program is designed, a customized approach that targets the barriers preventing adolescents from quitting smoking must be considered (Vuckovic, Polen, and Hollis, 2003). Evidence-based, effective smoking-cessation strategies must be identified to provide adolescents with appropriate support. We assumed that beneficial results can be obtained by implementing an intervention that is evidence-based and designed based on a customized approach.

A meta-analysis of teenage smoking cessation trials revealed that a classroom-based smoking cessation curriculum effectively helped students quit (Sussman, Sun, and Dent, 2006). Another review of smoking cessation programs for adolescents suggested that a motivational enhancement component was encouraged (Baker et al., 2012), because motivation to quit is a significant predictor for improving intervention success. The approach emphasizes the skills required to enhance the motivation and confidence of a smoker to quit. However, coping with the difficulties that emerge after quitting cannot be ignored (Fiore et al., 2008; Gwaltney, Bartolomei, Colby, and Kahler, 2008). Countermeasures for overcoming these obstacles must be included in smoking-cessation programs. An alternative technique is acupressure, which is conducted according to the principles of traditional Chinese medicine (TCM). Acupressure involves applying finger pressure at specific acupoints to regulate physiological reactions and to restore harmony and balance in the body (Yeh and Chen, 2005). Adolescents can perform this noninvasive technique (Chen, Yeh, and Chao, 2006), which has been shown to help adolescents manages stress (Das, Nayak, and Margaret, 2011) and quit smoking (Chen et al., 2006). Thus, our program began with a classroom-based smoking cessation curriculum integrated with acupressure, a culturally familiar noninvasive technique.

Another critical concern, increasing adolescent retention during a study, was elicited by a systematic review (Garrison, Christakis, Ebel, Wiehe, and Rivara, 2003). This is a common disadvantage of classroom-based interventions for voluntary participants. New modes of communication must be created. Extending the connection with students outside the classroom (Lancaster and Stead, 2005) and targeting difficulties that students encounter in quitting smoking can increase students' participation in smoking cessation programs. Curry, Mermelstein, and Sporer (2009) suggested two innovative intervention channels for youth tobacco cessation: proactive telephone counseling and mobile phone text messaging. Proactive counseling on the telephone improves adolescents' motivation to quit smoking and helps them overcome smoking-cessation obstacles (Kealey et al., 2009; Peterson et al., 2009). Free et al. (2009) applied text messaging using mobile phones in conducting adult smoking cessation programs, and the treatment yielded short-term effectiveness.

Providing coupon-based incentives can be an effective approach to encouraging positive behavior and is commonly used as responsive-contingent reinforcement in school. A previous study suggested that appropriate shaping by reinforcing initial attempts to quit can also improve the efficacy of smoking-cessation programs for people who are difficult to treat (Lamb, Kirby, Morral, Galbicka, and Iguchi, 2010). To reinforce students to sustain abstinence, coupon-based incentives were adopted for the proposed program as credit for the effort to change.

Our objectives in this study were (a) to develop an evidence-based, integrated smoking-cessation program for student smokers at vocational high schools targeting students' barriers against quitting smoking and (b) to evaluate the effectiveness of this intervention program. Specific hypotheses were proposed to establish (a) whether students who participated in the program would exhibit different rates of abstinence and (b) whether these students would exhibit differences in the forms of smoking and cognitive status. The differences were evaluated according to days smoked in the past month, the number of cigarettes smoked per day, nicotine dependence, the decisional balance of smoking, and self-efficacy in smoking cessation.

2. Methods

2.1. Participants and procedures

The participants were regular smokers who were (a) thinking of quitting smoking, (b) not pregnant, (c) not suffering from any major chronic diseases (e.g., asthma, heart disease, or diabetes), (d) willing to comply with verbal instructions, and (e) able to provide a signed informed-consent form. Numerous strategies, including distributing flyers and posters in each class, advertising on bulletin boards and Web sites, and suspending banners on campus, were employed at the selected schools to recruit participants. Student smokers were informed that they would be requested to undergo urine cotinine tests if they reported that they had quit smoking.

All participants were enrolled from six vocational high schools in New Taipei City, Taiwan. The research team visited the schools and presented the program to the principals and other appropriate personnel. Program materials were distributed and discussed during the meetings. In addition, we conducted question-and-answer sessions to address potential barriers related to implementing the program. After submitting the consent forms, the participants in the intervention group underwent the 12-week program, whereas the participants in the comparison group received educational flyers related to smoking cessation.

In this study, the intervention and comparison groups were compared based on four-time repeated measurements. Because the barriers preventing students from quitting smoking were addressed, we expected the program to produce a medium effect. When α was set at 0.05, a sample size of 35 students per group was required to achieve a power of 0.8 and a medium effect size of 0.3 for measurements repeated four times (Stevens, 2009). Data collection was conducted at the baseline (T1), the end of the program (T2), and 1-month (T3) and 4-month follow-up (T4) time points.

Considering the potential attrition of participants by T4, we doubled the required number of participants to 70 to ensure that we would have a sufficient number of students remaining at the 4-month follow-up. A total of 143 students enrolled in the study; 78 students were included in the intervention group and 65 students were included in the comparison group. Fig. 1 depicts a flowchart showing participant enrollment and assessments.

2.2. Program design

Responsive components that targeted the barriers preventing students from quitting smoking were integrated into the proposed program. The linkages of barriers, responsive designs, evidence-based interventions, and outcome measures are delineated in Fig. 2. During program development, we invited students (four male adolescents