Smokeless Tobacco Cessation Intervention for College Athletes: Results After 1 Year

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ABSTRACT

Objectives. The purpose of this study was to determine the efficacy of a college-based smokeless tobacco cessation intervention targeting college athletes.

Methods. Sixteen colleges were matched for prevalence of smokeless tobacco use in their combined baseball and football teams and randomly assigned within college pairs to the intervention or the control group. One-year prevalence of cessation among smokeless tobacco users was determined by self-report of abstinence for the previous 30 days. Differences between groups were analyzed in a weighted version of the Fisher 1-sided permutation test for paired samples after adjustment for significant predictors of quitting other than the intervention (i.e., smokeless tobacco uses per week and most frequently used brand).

Results. Cessation prevalences were 35% in the intervention colleges and 16% in the control colleges when subjects with unknown quit status were defined as nonquitters. After adjustment for other significant predictors of quitting, the difference of 19% increased to 21%. The intervention effect increased with level of smokeless tobacco use.

Conclusions. This intervention was effective in promoting smokeless tobacco cessation, especially among those who were more frequent users. (*Am J Public Health.* 1999;89:228–234)

Male athletes are frequent users of oral snuff and chewing tobacco, also known as smokeless or spit tobacco. (Note: Former US Surgeon General Antonia Novello recommended using *spit* rather than *smokeless* to prevent the impression that smokeless tobacco is harmless.) Studies have found smokeless tobacco prevalences of 52% to 55% and 26% to 36% among college varsity baseball and football players, respectively.[1-4]

Long-term use of smokeless tobacco increases risks of oral cancer,[5] oral leukoplakia,[6] periodontal disease,[7] and, possibly, cardiovascular disease.[8,9] Also, nicotine addiction may deter users of smokeless tobacco from quitting or lead them to use cigarettes or other sources of nicotine.[10]

There are few published studies of smokeless tobacco cessation. Early studies using an adapted version of the American Cancer Society's "Fresh Start Program"[11] or small group counseling and telephone follow-up with male adolescents[12] reported quit rates at 6 months of 2.3% and 8%, respectively. These studies, however, were not randomized controlled trials.

More recently, the efficacy of dental-based smokeless tobacco interventions has been reported.[13,14] In one study, male dental patients who used smokeless tobacco daily were randomly assigned to either usual care or usual care plus intervention: an oral soft tissue examination with special attention to oral lesions, advice to quit, a self-help manual, a 9-minute videotape, a brief counseling session with the dental hygienist, a follow-up telephone call, and mailings. A significantly larger proportion of subjects in the intervention group than in the usual-care control group reported abstinence from smokeless tobacco at 3 months (32% intervention vs 21% usual care; $P < .01$) and 12 months (18% vs 13%; $P < .01$).

We tested the efficacy of a similar dentist/dental hygienist–delivered smokeless tobacco cessation intervention among male college baseball and football athletes. We report here the 1-year results of our randomized controlled trial conducted in 16 California colleges.

Methods

Design and Recruitment

Because our definition of a current user of smokeless tobacco (use more than once per month and within the past month) was broader than that used in previous reports of smokeless tobacco cessation,[11,12] we designed this study to detect a difference of 9% (1% control group vs 10% intervention group) in 1-year cessation prevalence. College was the unit of randomization in order to prevent possible dilution of the intervention effect by communication between members of control and intervention groups within the same school. Using a .05-level 1-sided test in the presence of an intraclass correlation of .02 to account for the clustering effect of colleges[15,16] required 314 smokeless tobacco users, or 16 colleges with an average of 23 smokeless tobacco users per college, to achieve a power of .90.

Colleges included in our study were selected from lists of all publicly supported

California universities and community colleges. By design, half were urban and half rural, and all had both varsity football and baseball teams. A college was considered rural if it was located in a county with a population density of fewer than 150 persons per square mile according to the 1990 US Census. Of 35 colleges contacted, the first 16 that had both baseball and football teams and indicated willingness to participate were enrolled; collectively, these 16 insitutions represented 18% of the public colleges in California offering both sports.

We contacted the athletic directors and coaches of the 16 study colleges in 1990/91 for permission to recruit varsity athletes at a team meeting early in their athletic season for participation in the study. At each meeting, the study was explained and informed consent obtained. On average, 81% of team members participated (range: 44%–100%).

Baseline Assessments and Randomization

All players who consented to participate completed a 5-page questionnaire assessing demographic and smokeless tobacco use variables. The questionnaire (described elsewhere)[17] was distributed to football and baseball athletes by 2 trained research assistants and was coded so that individuals could be identified only by research staff. Subjects were assured of confidentiality. Current and permanent addresses and phone numbers were collected from each participant, along with names and addresses of 2 people who would know his whereabouts a year later.

We delivered an athletic team–based intervention, since football teams are formed in the fall and baseball teams in the spring. The baseline questionnaires were administered to each team to estimate prevalence of smokeless tobacco use within each college. The colleges were then pair matched by baseline prevalence of smokeless tobacco use, and 1 college from each pair was randomized to receive the intervention, while the other college in the pair received no intervention.

As a result of the different training schedules for baseball and football, college-wise baseline prevalence data for pair-matched randomization were collected in 1990/91, while intervention activities took place during the 1991/92 school year. To account for possible changes in smokeless tobacco use status, we readministered the baseline questionnaire to all members of the 1991/92 varsity teams who consented to participate, although the pair-matched design prevented us from re-randomizing colleges using the second questionnaire prevalence

data. The questionnaire and intervention were pilot tested in 4 colleges not included in the final study sample.

The Intervention

The intervention was an athletic team–based smokeless tobacco cessation program based on cognitive social learning theory.[18] The intervention was conducted in college athletic facilities, where a dentist performed a 3- to 5-minute oral soft tissue examination of each team member, advised smokeless tobacco users to quit tobacco use, pointed out smokeless tobacco–related tissue changes in the player's own mouth or in photographs of the mouths of others of similar age, showed photographs of facial disfigurement due to oral cancer, provided a self-help guide for quitting smokeless tobacco use,[19] and offered smokeless tobacco users a single 15- to 20-minute session of individual counseling that day by a dental hygienist. This counseling focused on reviewing the addictive nature of smokeless tobacco and the difficulty of nicotine withdrawal, setting a quit date, developing a plan to get ready to quit (i.e., cutting back use of smokeless tobacco to half the usual amount, practicing going without smokeless tobacco at favorite times, and using oral nontobacco substitutes), and identifying events that trigger smokeless tobacco use and ways to cope with these situations. Also, 2-mg nicotine gum was offered to mitigate withdrawal symptoms. As a means of creating a team environment supportive of quitting, the dental hygienist also met with nonusers in small groups of 3 to 5 players to discuss the quitting process and to ask them to encourage teammates who were trying to quit their smokeless tobacco use. The dental hygienist also made two 5- to 10-minute follow-up telephone calls on the quit date and 1 month later to answer questions and express concern.

Interventionists were trained and then screened for skill and consistency in videotaped mock interventions during 1-day workshops,[17] received continuing education credit, and were observed by study personnel on intervention days to assess compliance with the protocol. The dental interventionists, 4 dentists (2 male and 2 female) and 8 dental hygienists (all female), were assigned to colleges in teams of 1 dentist and 2 dental hygienists per college based on schedule availablility.

Follow-Up Assessments

Attempts were made to contact all baseline smokeless tobacco users at their college

athletic facilities 1 year after baseline assessments to have them complete a follow-up self-administered confidential questionnaire on their smokeless tobacco use status and to collect a saliva sample from those who reported quitting smokeless tobacco use. Before the questionnaire was administered, respondents were informed that biochemical analysis of saliva could reveal smokeless tobacco use and verify self-reported quit status. Subjects who were no longer on a college athletic team completed the questionnaire by telephone interview after the interviewer explained the rationale for saliva collection. Because saliva assay to validate smokeless tobacco quit status would be limited owing to the disparity between our definition of a quitter and the 20-hour half-life of cotinine,[20] we used saliva collection at 1 year to enhance the accuracy of self-report rather than to validate it. Therefore, prevalences of smokeless tobacco cessation reported here are based only on self-report. A quitter was defined as a baseline smokeless tobacco user who, at 1 year, reported himself free of smokeless tobacco use for at least the previous 30 days.

From a list of quit strategies, subjects who reported either quitting or trying to quit smokeless tobacco use checked those they had used and also indicated whether they believed their actions to quit smokeless tobacco use had affected their athletic performance. All intervention group subjects were asked whether the intervention program should be repeated and to rate the importance of each of its components in facilitating the quitting process.

Statistical Analysis

We identified, a priori, 12 factors other than the intervention that might be predictive of quitting smokeless tobacco use and that might explain a difference between groups. These factors can be grouped as follows: demographic factors (race, sport, and whether hometown location was urban or rural), characteristics of smokeless tobacco use (time to first smokeless tobacco use after waking, number of uses per week, hours of use per week, seasonality of use, and type [dip/chew] and brand most commonly used), and motivation to quit (perceived need for smokeless tobacco, level of commitment to quitting, and history of attempts to quit). For analysis, race was classified as White or other, since few subjects were members of specific racial groups other than White. The number of smokeless tobacco uses per week was collapsed into 4 categories.[21] Commitment-to-quitting responses were assessed on an 11-point scale, and perceived need for

smokeless tobacco was measured on a 10-point scale.

To develop a multivariate model of predictors of quitting, we first combined intervention and control subjects and measured univariate associations between each variable and 1-year quit status in logistic regression models, adjusted for college, with subject as the unit of analysis. We next analyzed sets of these variables in 3 models, one including demographic factors, another including smokeless tobacco use characteristics, and the third including factors related to motivation to quit. This strategy was chosen to check for collinearities among variables and to reduce the number of subjects excluded from a model owing to missing data on 1 or more predictors. Any predictors identified as significant at the $\alpha = .05$ level via backward selection were entered into a fourth multivariate model, and the selection process was repeated. Following the method of the Community Intervention Trial for Smoking Cessation (COMMIT) Research Group,[22] expected probabilities of quitting smokeless tobacco use were estimated by the final model, which was adjusted for college pairs to reflect the assumption that the null hypothesis was true, and then averaged within each of the 16 colleges; we denote these expected probabilities by (e_{Ii}, e_{Ci}), $i = 1, \ldots, 8$, for the 8 college pairs. Observed probabilities were estimated via the college-specific proportions of participants who reported quitting smokeless tobacco use, denoted (o_{Ii}, o_{Ci}), $i = 1, \ldots, 8$, and residuals were calculated as observed minus expected quit rates, $r_{Ii} = o_{Ii} - e_{Ii}$ and $r_{Ci} = o_{Ci} - e_{Ci}$, $i = 1, \ldots 8$. Finally, differences between paired residuals, $d_i = r_{Ii} - r_{Ci}$, $i = 1, \ldots, 8$, provided estimates of the intervention effect within matched pairs after adjustment for the statistically significant predictors identified earlier. We used a 1-sided Fisher permutation test[15,16,23] for paired samples to test the null hypothesis of no difference in quit rates between groups, and we used the exact distribution of the estimate to construct a 95% confidence interval for the intervention effect. The test statistic was based on a weighted average of the difference in estimated paired residuals, $\Delta_r = \Sigma w_i d_i / \Sigma w_i$. The weights calculated for each college pair were based on the sample sizes of the intervention (n_{Ii}) and control (n_{Ci}) groups: $w_i = n_{Ii} n_{Ci} / (n_{Ii} + n_{Ci})$. An unadjusted estimate of the intervention effect is given by $\Delta = \Sigma w_i (o_{Ii} - o_{Ci}) / w_i$.

Since the intervention was delivered separately by sport within each college, we also tested the intervention effect within sport using 1-sided tests, and we tested the interaction effect between sport and intervention group using a 2-sided permutation test. These tests also were adjusted for the

predictive factors identified in the overall multivariate analysis.

Quit status at 1 year was defined under the conservative assumption that subjects with unknown quit status did not quit smokeless tobacco use. For subjects who reported quitting or attempting to quit, frequencies of responses regarding quit strategies they used and the self-reported effects of those strategies on athletic performance were compared between groups. For intervention group subjects, mean ratings of the importance of the intervention components were calculated overall and by smokeless tobacco use category. Linear-by-linear associations between these ratings and baseline self-reports of smokeless tobacco uses per week, in 4 categories,[22] were assessed via 2-sided Cochran–Mantel–Haenszel χ^2 tests.

Results

Matching and Balance Between Groups

The overall target size of 23 subjects per college, on average, was achieved. The intervention (n = 171) and control (n = 189) groups were similar with respect to demographic factors and did not differ remarkably in smokeless tobacco use characteristics or motivation to quit (data not shown). Fewer than 2% of subjects were current smokers at baseline.

Predictors of 1-Year Quit Status

Univariate logistic regression models showed that all 5 smokeless tobacco use characteristics and both perceived need for smokeless tobacco and commitment to quitting were significantly associated with quitting ($P < .001$) (Table 1). We evaluated quit status as a quadratic function of commitment to quitting rather than as a linear function, and we found the quadratic term to be highly significant ($P = .003$). This model allowed for the possibility that subjects were committed to quitting (1) because they had a low perceived need for smokeless tobacco and expected quitting to be easy and (2) because they had a high perceived need and wanted to break the habit.

In the multivariate logistic model of demographic factors (n = 238), no factor was significant at the $\alpha = .05$ level. The multivariate model of smokeless tobacco use characteristics (n = 324) showed that fewer smokeless tobacco uses per week and use of chewing tobacco or a brand of dip (snuff) other than Copenhagen or Skoal were significantly associated with quitting smokeless tobacco use ($P < .001$). In the multivariate

model of motivation-to-quit characteristics (n = 304), only perceived need for smokeless tobacco was statistically significant. The fourth model included the 2 significant smokeless tobacco use characteristics, sport, and perceived need for smokeless tobacco; neither of the latter 2 variables was found to be significant. Thus, expected probabilities of quitting were generated from a model that included smokeless tobacco uses per week and brand of smokeless tobacco, adjusted for college pair.

Effectiveness of the Intervention

The overall intervention effect (Δ_r), adjusted for smokeless tobacco uses per week and most frequently used brand of smokeless tobacco, was .205 ($P = .008$) (Table 2). On average, the overall observed quit rates were 34.5% at intervention colleges and 15.9% at control colleges. The nonresponse rates were 10% of 171 intervention subjects and 5% of 189 control subjects.

Table 2 lists college pairs in order of increasing prevalence of smokeless tobacco use at randomization. The number of smokeless tobacco users and the 1-year prevalence of cessation varied by college. Nonetheless, the differences in paired residuals were usually positive, especially for the baseball teams, which tended to have larger numbers of smokeless tobacco users than the football teams. The interaction between sport and intervention was not statistically significant ($P = .12$).

When we examined prevalence of cessation by amount of smokeless tobacco used in both the intervention and control groups, we found a similar proportion of quitters among those who used smokeless tobacco 3 times or less per week (intervention, 38%; control, 37%). As the number of smokeless tobacco uses per week increased, differences in proportions of quitters were apparent between the groups (4–16 uses per week: intervention, 45%, and control, 26%; 17–29 uses per week: intervention, 22%, and control, 6%; 30 or more uses per week: intervention, 22%, and control, 4%), showing that the effectiveness of the intervention increased with level of smokeless tobacco use.

Techniques Used in Efforts to Quit Smokeless Tobacco Use

Table 3 shows strategies used by subjects to quit smokeless tobacco use. Although similar proportions of athletes who quit or tried to quit in both groups "just quit," switched to a lower-nicotine-content brand

to wean themselves off nicotine, and/or increased alcohol or cigarette consumption, more subjects in the intervention group gradually reduced their smokeless tobacco use by cutting back to half their usual amount of smokeless tobacco or by cutting out use at a few of their favorite times and using nontobacco substitutes. Twenty-four athletes in the intervention group, as compared with 1 in the control group, used nicotine gum; of these individuals, only 3 (all in the intervention group) succeeded in quitting.

Of the smokeless tobacco users at baseline who were nonsmokers, 4% (7 in the intervention group and 5 in the control group) started smoking cigarettes. Of these athletes, only 1 in the intervention group quit using smokeless tobacco. In addition, 4% of those smokeless tobacco users who either quit or attempted unsuccessfully to quit reported increased alcohol consumption as a technique used in their efforts to stop smokeless tobacco use.

Table 4 shows the perceived importance of the intervention components in helping smokeless tobacco users to quit. On average, intervention group subjects found viewing graphic photographs of the oral consequences of tobacco use and the mouth examination by a dental professional to be the most helpful components of the intervention; they found nicotine gum and a nontobacco mint-flavored snufflike product to be the least important components.

Some of these evaluations varied with baseline self-report of frequency of smokeless tobacco use per week (data not shown). In particular, more frequent users of smokeless tobacco found seeing smokeless tobacco–related changes in their own mouth and tapering down use to be much more important than did less frequent users ($P < .0003$). Finally, 95% of 142 intervention subjects who responded thought the intervention program should be repeated, and more than 90% of all responding athletes who quit or seriously tried to quit using smokeless tobacco reported that their quit attempts had no effect on their athletic performance.

Discussion

Overall, our intervention approximately doubled the quit rate observed in the control group. The proportions of users who quit smokeless tobacco use were 35% in intervention colleges and 16% in control colleges, yielding an unadjusted difference between groups of 19%. After adjustment for the paired design and for factors associated with quitting smokeless tobacco use, the dif-

TABLE 1—Univariate Associations Between Quitting Smokeless Tobacco (ST) Use and Baseline Characteristics Among ST-Using Athletes in 16 California Colleges: Intervention and Control Groups Combined

	Overall Sample (n = 360), No.	Quitters, %	P
Demographic factors			
Race			.286
White	247	25.9	
Other	51	39.2	
Hometown location			.398
City/suburb	156	33.3	
Small town/farm	98	24.5	
Sport			.081
Football	118	34.7	
Baseball	215	27.0	
ST use characteristics			
ST uses per week[a]			<.0001
<3	61	52.5	
4–16	98	39.8	
17–29	90	17.8	
>30	77	9.1	
Hours of ST use per week			<.0001
<2	92	44.7	
2–4	59	21.3	
5–9	80	21.3	
>10	95	12.8	
Seasonality of ST use			.0002
Seasonally	101	45.5	
Year-round	228	22.4	
First ST use after waking			.0005
>3 hours	199	36.2	
90 minutes to 3 hours	54	20.4	
30–90 minutes	43	16.3	
<30 minutes	28	14.3	
Brand of ST[b]			<.0001
Chew	67	55.2	
Dip: other	55	34.5	
Dip: Skoal	64	23.4	
Dip: Copenhagen	146	18.5	
Motivation to quit			
Perceived need for ST[a]			<.0001
Low (1–3)	109	45.9	
Moderate (4–6)	114	23.7	
High (7–10)	103	17.5	
History of attempts to quit			.250
No	187	30.5	
Yes	140	27.1	
Commitment to quitting[c]			.0017
High (7–10)	111	26.1	
Moderate (4–6)	84	21.4	
Low (0–3)	109	35.8	

[a]Continuous variable analyzed.
[b]Unordered categories.
[c]Quadratic term included in model.

ference increased slightly, to 21%. The anticipated intervention effect of 9% was achieved in 5 of 8 college pairs. Differences in the size of the intervention effect among colleges may have been partly due to varying degrees of support for the intervention by team leaders.

The design of this study called for analysis of 1-year results; however, since we also collected 3-month cessation data,[17] we can use these data to aid in the interpretation of the 1-year findings. Subjects with known quit status at either the 3-month or the 1-year fol-low-up assessments can be classified into 3 groups (subjects whose quit status was unknown were considered to be nonquitters): (1) those who quit within 3 months (intervention, 23%; control, 15%), (2) those who quit within 1 year (intervention, 36%; control, 16%), and (3) those who had quit by 3 months and remained abstinent at 1 year (intervention, 13%; control, 9%). The adjusted analysis for those subjects who reported cessation of smokeless tobacco use at both time periods provided a lower estimate (4% difference) of the intervention

TABLE 2—Prevalence of Smokeless Tobacco (ST) Cessation in Intervention and Control College Pairs

College Pair	Intervention		Control		Difference	
	No. of ST Users	Quit Rate	No. of ST Users	Quit Rate	Δ^a	Δ_r^b
1	15	.467	15	.133	.333	.279
2	15	.267	19	.263	.004	−.004
3	21	.286	22	.182	.104	.047
4	15	.267	27	.185	.081	.143
5	10	.300	29	.241	.059	.154
6	32	.188	22	.091	.097	.073
7	35	.314	17	.059	.255	.200
8	24	.625	32	.063	.563	.410
Weighted average	...	.345	...	.159	.186	.205^c

Note. Subjects with missing quit status were assumed to be nonquitters (intervention, n = 17; control, n = 10).
[a]Difference between groups, not adjusted.
[b]Difference between groups, adjusted for paired design and two covariates: ST uses per week and most frequently used brand of ST.
[c]95% confidence interval: .035, .380.

effect than the analysis reported here (21% difference), and the estimate was slightly less than the 5% difference (intervention, 18%; control, 13%) reported by others[14] among daily users for the same 12-month period. Comparison of the 3-month and 1-year results indicates that in the interval between the 2 assessments, more intervention than control subjects quit. We do not believe that this difference reflects bias, since intervention activities occurred only at the start of the study and all subjects were contacted and treated equally between the 3-month and 1-year assessments. Rather, we hypothesize that the unexpected increase in the intervention group quit rate between the 3-month and 1-year assessments was a result of these subjects' being contacted for the 3-month assessment and indirectly reminded of having set a goal to quit smokeless tobacco use. Such a "boost" may be an important component of a smokeless tobacco cessation program, especially for individuals with a history of frequent smokeless tobacco use. When we examined quit rates by subgroups, most of the increase occurred among baseball athletes and among those who were more frequent smokeless tobacco users. Available data indicate that most smokers experience a series of relapses before quitting successfully.[24,25]

When asked on the questionnaire which components of the intervention were most helpful in assisting in their attempt to quit smokeless tobacco use, more than 95% of subjects selected viewing graphic photographs of oral cancer–related disfigurement and receiving a mouth examination with feedback about oral tissue damage related to smokeless tobacco use. These findings are consistent with those of other studies involving athletes[4,13] and with suggestions in the literature[26,27] that use of physical attractiveness and short-term health effects as methods of deterring tobacco use may be

more effective for youth than emphasizing long-term health effects. Our findings also support the explanation that the process of looking for smokeless tobacco–associated lesions in an athlete's mouth, pointing them out either directly or in photographs, and linking them to possible malignant transformation and facial disfigurement was important in mediating the effect of the intervention. This process provided information about action–consequence relationships that heightened the athlete's feeling of susceptibility to a problem, causing him to weigh the pros and cons of quitting smokeless tobacco use and providing incentive to motivate a decision to try to quit.

Moreover, 33% of users in the intervention group, as compared with 19% in the control group, were more likely to reduce their smokeless tobacco use gradually in their efforts to quit. This systematic tapering down of smokeless tobacco use prior to quitting "cold turkey" was a strategy recommended during cessation counseling for the more nicotine-dependent users, and our findings reflect that this recommendation was actually implemented. Consistent with cognitive social learning theory,[18] our in-person and telephone counseling effected competency for quitting by direct skill training and promoted

feelings of self-efficacy by addressing behavioral change over time. We believe that these problem-solving and supportive processes contributed to the intervention effect.

That more frequent smokeless tobacco users found seeing changes in their own mouth and tapering down use to be more helpful in quitting than did less frequent users is probably due to the former group's being more likely to have smokeless tobacco–associated oral lesions[6] and to be more nicotine dependent.

In this study, 2-mg nicotine gum did not appear to promote smokeless tobacco cessation; however, few subjects used it (n = 24), and compliance was not monitored. Nevertheless, others have found no differences in smokeless tobacco abstinence rates between placebo gum and 2-mg gum.[28,29] Future studies should examine higher dose nicotine gum and the nicotine patch for treatment of addicted smokeless tobacco users.

When quitters in both groups were combined, overall predictors of quitting were smokeless tobacco uses per week and brand used. These variables relate to level of nicotine exposure, which in turn is related to nicotine addiction.[21,30–32] The largest proportion of quitters in both groups were subjects with relatively low smokeless tobacco use

TABLE 3—Strategies Used by Intervention (n = 153) and Control (n = 171) Subjects When Attempting to Quit Using Smokeless Tobacco

Strategy	Intervention, % (No.)	Control, % (No.)
Just quit	61 (93)	58 (100)
Cut use during favorite times, used oral substitutes	35 (55)	27 (34)
Cut back to half usual amount	33 (51)	19 (32)
Used nicotine gum	16 (24)	1 (1)
Switched brands	11 (17)	8 (14)
Increased alcohol consumption	5 (5)	5 (7)
Started cigarette smoking	5 (7)	4 (5)
Used nicotine patch	3 (4)	2 (4)

TABLE 4—Perceived Importance of Components of the Intervention Among Smokeless Tobacco Users in the Intervention Group

Component	No.	Average Score[a]
Photo of disfigurement	147	1.72
Mouth exam with feedback	148	1.12
Advice to quit	145	0.92
Nontobacco oral substitutes	144	0.92
Tapering down	143	0.22
Dental hygienist counseling	143	0.049
Support from others	130	−0.062
Telephone follow-up	133	−0.56
Self-help guide	146	−0.73
Mint snuff	140	−1.16
Nicotine gum	110	−2.03

[a]Scoring: −3, not important; −1, slightly important; 1, moderately important; 3, highly important.

rates (3 or fewer times per week), who can be considered nonaddicted. Although quit rates were lower for more addicted subjects, such as baseball players who were frequent users, the intervention effect was stronger in these subjects.

That 12 of the smokeless tobacco users (4%) started smoking in their attempt to quit using smokeless tobacco is alarming and highlights the importance of providing an unambiguous message to smokeless tobacco users that all tobacco products are harmful and that one should never substitute smoking for smokeless tobacco.

Estimates of prevalence of smokeless tobacco cessation in this study were based on self-report. However, we did use a bogus pipeline procedure[32,33] (i.e., informing subjects that biochemical assessments would be used to assess tobacco use status when most would actually be collected but not evaluated), since it has been reported to increase disclosure of tobacco use when subjects are assured confidentiality but not anonymity.[34,35] Research has indicated that biochemical checks may be omitted without serious risk to reliability and validity under rigorous research conditions in which confidentiality has been promised and accepted.[36]

A limitation of our study is that the paired college design required the group assignments to be based on prevalence surveys conducted during a single school year, while the intervention was delivered to teams formed the following year. Nonetheless, the intervention and control groups were similar in smokeless tobacco use prevalence at baseline. Another limitation is that we did not collect data on other possible smokeless tobacco cessation influences, such as the schools' tobacco use policies and the attitudes and behaviors of coaches and peer leaders regarding tobacco use. Such ecological data that might influence the outcome of

an intervention study or its proper interpretation should be collected prospectively.

Our 1-year point prevalence of cessation was somewhat higher than the 6% reported by Stevens et al.[14] Unlike their study, ours included smokeless tobacco users who had a regular but relatively low frequency of tobacco use, in addition to daily users. Also, the fact that almost two thirds of our subjects reported moderate or high motivation to quit may have contributed to the success of our intervention. However, both the intervention and control groups were balanced with respect to this variable, and, in the multivariate model of motivation-to-quit characteristics (n = 304), motivation to quit was not found to be a significant predictor of quitting smokeless tobacco use. Our findings and those of others[13,14] indicate that an oral examination by a dental professional who points out tissue damage from smokeless tobacco use in a user's own mouth, advice to quit, and brief problem solving and supportive counseling are effective in promoting smokeless tobacco cessation. Since the American Dental Association and the American Dental Hygiene Association formally support involvement of their members in tobacco cessation activities,[37,38] it may be feasible for this college-based intervention to become part of the annual mandated preseason health screening of college athletes and to be implemented as part of the ongoing community service programs sponsored by local dental and dental hygiene societies. □

Contributors

Margaret Walsh conceived the initial research hypothesis, wrote the first draft of the article, developed the intervention, trained study personnel, and oversaw recruitment of the study sample and data collection and assembly. Margaret Walsh, Virginia Ernster, and Margaret Chesney designed the study and participated in developing the questionnaire,

interpreting data, and writing the paper. Joan Hilton participated in developing the questionnaire, designed and directed the data analysis, drafted the statistical analysis section of the article, and critically revised the article for important intellectual content. Claudia Masouredis participated in questionnaire development and training of study interventionists, transported saliva samples for assay and logged results, and provided oral screening examinations. Lauren Gee performed the data analysis and participated in developing the questionnaire and writing the article. All authors had final approval of the article and take responsibility for its content.

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