

## Spit (smokeless) tobacco use by high school baseball athletes in California

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### Abstract

**Objective**—To describe the prevalence, patterns, and correlates of spit (smokeless) tobacco (ST) use in a sample of high school baseball athletes in California.

**Design**—This cross sectional study was a survey of 1226 baseball athletes attending 39 California high schools that were randomly selected from a list of all publicly supported high schools with baseball teams. At a baseball team meeting, athletes who agreed to participate and had parental consent completed the study questionnaire. To enhance the accuracy of self reported ST use status, a saliva sample was collected from each subject. The questionnaires and saliva samples were coded and salivary cotinine assay was performed on a random subsample of 5% of non-users who also were non-smokers. Biochemical assay indicated that 2% tested positive for cotinine inconsistent with self reported ST non-use.

**Results**—Overall, 46% had ever used ST and 15% were current users. Odds ratios and 95% confidence intervals (CI) suggested that, among high school baseball athletes, age, living in a rural area, being white, smoking cigarettes, drinking alcohol, not knowing about the adverse effects of ST, perceiving little personal risk associated with ST use, and believing that friends, role models, teammates, and same age baseball athletes in general used ST, increased the likelihood of being an ST user.

**Conclusion**—The findings indicate that considerable experimentation with ST products occurs among high school baseball athletes in California, and many are current users. ST interventions targeting this population are needed to stop the transition from experimental ST use to tobacco dependence. Correlates of ST use for consideration in future intervention studies are identified.

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The negative health effects associated with spit (smokeless) tobacco (ST) use include oral, pharyngeal, and oesophageal cancer,<sup>1</sup> oral leukoplakia<sup>2-3</sup> (a premalignant lesion<sup>4</sup>), cardiovascular disease,<sup>5</sup> periodontal disease,<sup>6</sup> and nicotine addiction.<sup>7</sup> In addition, ST use has

been shown to produce similar levels of nicotine in the body as does cigarette smoking.<sup>8</sup>

Research indicates ST use does not improve<sup>9-11</sup> and may decrease<sup>12-15</sup> athletic performance. Nonetheless, athletes, particularly baseball players, are known to be heavy users of ST.<sup>14-17</sup> Studies have found use rates of 34%<sup>18</sup> and 39%<sup>19</sup> among professional baseball players and 57% among National Collegiate Athletic Association baseball players.<sup>14</sup> In 1991, we surveyed 1328 college athletes in California and found that 52% of baseball players and 26% of football players used ST at least weekly, with 71% of all weekly users having used it daily. Of these college users (n = 473), 48% reported that they began using ST more than once a month during their high school years.<sup>17</sup> Although national data for high school males show that 12% use ST products regularly,<sup>20</sup> and studies have documented that young males frequently use ST when playing or watching a sport,<sup>21-24</sup> no data focusing on ST use by high school baseball athletes have been reported to date. As a result, we conducted a cross sectional study to describe the prevalence, patterns, and correlates of ST use in a sample of high school baseball athletes in California to inform the need for interventions targeting this population.

Based on our own prior work with college athletes,<sup>17</sup> ST prevalence data from national surveys of teenagers,<sup>20-21-25</sup> and literature on other forms of tobacco use among adolescents,<sup>26</sup> we hypothesised that ST use would be associated with living in a rural area; being older, white, a cigarette smoker, and a drinker of alcohol; perceiving low risk associated with ST use and high use among friends, relatives, coaches, teammates and same age baseball athletes in general; and responding incorrectly to questions about the adverse health effects associated with ST use. In addition, we hypothesised that athletes who used both snuff and chewing tobacco would be more likely to have indications of nicotine addiction than athletes who used snuff only; and that athletes who used snuff only would be more likely to have indications of nicotine addiction than athletes who used chewing tobacco only. Such data are important to determine a need for tobacco control interventions targeting this population and to identify variables for use in planning such interventions.

Variables that distinguish among levels of prevalence of ST use are important in defining target populations, stratification factors, and covariates by which the main effects may

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require adjustment in group randomised intervention studies related to controlling tobacco use.

### Methods

#### SAMPLE SELECTION, RECRUITMENT, AND INFORMED CONSENT

Of 771 public high schools in California, 754 high schools (urban 73%, rural 27%) had baseball teams.<sup>27, 28</sup> We randomly sampled potentially eligible schools (that is, those with at least one baseball team) statewide.

Specifically, high schools included in our study were selected randomly from a list of all public high schools with baseball teams that was constructed from the California public schools directory<sup>27</sup> and the California coaches directory of high schools.<sup>28</sup> If either of these directories indicated the school had a baseball team, then the high school was included on the list of eligible study schools.

We recruited schools until a target sample size of 1200 subjects was reached. This sample size was based on our experience with college baseball athletes, of whom 52% were current ST users and 48% of these began using ST in high school. Adjusting downward by 50% to allow for lower ST use rates in underclassmen, we selected a sample size to allow us to estimate the anticipated high school prevalence of 12.5% with low error ( $\pm 2\%$ ) and to allow us to identify significant correlates of ST use. To recruit study high schools, we contacted principals at randomly selected schools to explain the study and invite their baseball teams to participate. If the principal declined, or did not respond to three phone messages, or if the school did not have a baseball team, then another school was randomly selected to replace it. Once a school was selected, we identified it as being urban or rural in location. A high school was considered rural if it was located in a town with a population of less than 50 000 residents and in a county with a population density of less than 1000 persons per square mile.<sup>29</sup>

During the 1995 spring baseball season, high school principals of the participating high schools sent a consent form prepared by study investigators to parents of all baseball athletes at their high school. The cover letter explained the purpose, methods, benefits and risks of the study and provided a toll free telephone number for parents to obtain answers to their questions from a study investigator. Parents were instructed that if they did not want their son to participate, they should sign the refusal statement on the form and return it to the baseball coach by a specific date. Fewer than 10% of parents refused consent for study participation.

At least two weeks after the deadline for parental refusal, a baseball team meeting was called by the baseball coach at each study school. At this meeting the study investigators obtained individual informed consent from the athletes who chose to participate in the survey and whose parents had not refused permission.

#### QUESTIONNAIRE DEVELOPMENT

Items relating to demographics, age, cigarette and alcohol use, ST use status, age of initiation, patterns of ST use, reasons for use, readiness to quit, quitting self efficacy, intention to use ST in the future, social influence factors, risk perceptions, and knowledge of ST use were included in the study questionnaire. Age of initiation of ST use was defined as first age of regular ST use more than once a month (not first experimentation). Patterns of ST use were assessed by: (1) asking players to specify the type, brand, amount, and frequency of their ST use; (2) asking if they used it seasonally or year round; and (3) using a question adapted from the tolerance questionnaire developed by Fagerstrom<sup>30</sup> that asked players how soon after waking they used ST.<sup>31</sup> In addition, a subjective measure of self perceived dependence on ST was collected by asking players to score themselves on a scale from 1 to 10 where 1 was "I don't need ST at all" and 10 was "I just have to have it".<sup>32</sup> In addition, quitting self efficacy was assessed by asking the player how confident he was that he could "quit for good" in the next 2–3 weeks, with four possible responses ranging from "not at all" to "very confident".<sup>33</sup>

The questionnaire also presented a list of reasons for using ST and asked players to indicate how important each reason was in their continued use. For each reason listed there were four possible responses, ranging from "not important" to "very important". In addition, factors relating to social norms were assessed by asking each athlete how many of his teammates used ST, and how many same aged baseball athletes in general he thought used ST. For both of these items there were four response options that ranged from "almost none" to "almost all of them". In addition, we asked each athlete to describe the ST use status of his best friend as either "a non-user", "an occasional user", or "a regular user", and whether or not his father and/or his baseball coach used ST (response options included "yes", "no", "I don't know"). To assess factors related to social pressure to use ST, we asked each athlete how many different people had tried to get him to use ST (four response options ranged from "none" to "more than six"). In addition, we asked whether or not it was hard to say no when he was offered ST (response options were "yes", "no", "sometimes", and "no one has ever tried to get me to use dip or chew"), and whether or not he thought people would still like him if he used ST (responses included "yes", "no", "not sure"). Finally, we asked questions about knowledge of negative health effects associated with ST use (true/false) and about how likely it was that the player would personally experience specific adverse health effects if he used ST. For each health risk listed, there were four possible responses, ranging from "very likely" to "very unlikely".

The questionnaire items were pilot tested by the baseball teams at four high schools (two urban and two rural) that were not included in the final study sample. Using information from

the pilot testing, we revised the questionnaire and ultimately settled on a 20–30 minute, 82 item questionnaire.

#### QUESTIONNAIRE ADMINISTRATION

At a baseball team meeting called by the baseball coach at each study school, and under the direction of trained study staff, each participating athlete self completed the study questionnaire. Before filling out the questionnaire, subjects were told that it asked about their use of tobacco, that biochemical assay of saliva could detect tobacco use, and that a sample of their saliva would be collected to check the truthfulness of their responses. We expected that telling students that their answer about ST use status could be checked biochemically would increase the accuracy of their self report.<sup>34</sup> For saliva collection, subjects chewed a piece of paraffin and 3 ml of saliva were collected in a plastic test tube. Salivary cotinine assay was performed on a random subsample of 5% (47/1016) of non-users of tobacco to estimate underreporting of ST use status; 2% (1/47) of those who did not report ST use on the questionnaire tested positive for cotinine (> 10 ng/ml). Two trained research staff collected saliva samples, assisted students in completing the questionnaire, and reviewed it for completeness before dismissing the students. The questionnaires and saliva samples were coded so that individuals could be identified only by the research staff.

#### DATA ANALYSIS

We analysed the prevalence of ST use by geographic location, age, ethnicity, other substance use, knowledge of the hazards of ST use, perception of use by significant others (best friends, fathers, and/or coaches), and beliefs about personal risk associated with ST use. As a measure of the association between the variables of interest and the likelihood of ST use, we calculated odds ratios (OR) and 95% confidence intervals (CI). An odds ratio estimates the odds of ST use (that is, the probability of use divided by the probability of non-use) in a category that we hypothesise is associated with increased use, relative to the odds in a category associated with lower use. Odds ratios that are significantly greater than one (that is, the lower bound of the 95% CI exceeds 1) provide evidence in support of our hypotheses. However, for comparison of addiction related characteristics of ST users by types of ST used, we employed trend tests. To eliminate potential confounding of ST related nicotine addiction by cigarette smoking, we excluded ST users who also smoked from the sample that we analysed. Finally, we calculated the percentage of ST users who identified from a list provided, specific important reasons for his ST use.

#### Results

In all, 106 high schools were contacted: seven refused to participate, 43 failed to respond to phone messages, and 17 were ineligible because they had discontinued their baseball programs (response rate 43.8% of 89 eligible

schools contacted). Fifteen (38%) of the 39 high schools enrolled in the study were located in rural areas, representing 7% (15/205) of rural high schools in California with baseball teams. Twenty four (62%) of the study high schools were in urban areas representing 4% (24/549) of urban California high schools with baseball teams. Collectively these 39 high schools represented 5% of the 754 potentially eligible public high schools in California with baseball teams.

At the study schools we recruited 1226 baseball athletes, 485 at 15 rural high schools and 741 at 24 urban high schools, to participate in the study. Most participants were white (64%), but a smaller proportion of the urban sample was white (58%) than of the rural sample (73%). Almost half the students drank some alcohol (45%), but only 4% were current smokers. The mean age of initiating alcohol drinking (10 or more drinks per year) and of starting to smoke cigarettes on a daily basis was 13.5 years for either behaviour. The mean age of initiation of ST use was 14.0 years.

#### PREVALENCE OF ST USE

Of the 1226 players, 54% (95% CI 50% to 58%) reported they had never used ST, 21% (95% CI 16% to 26%) reported they had tried it, 10% (95% CI 5% to 15%) reported former regular use, and 15% (95% CI 10% to 20%) reported current regular use. Table 1 shows that current ST use was higher among athletes in rural areas compared with athletes in urban areas (19% *v* 12%). Overall, whites and Native Americans were more likely to report ST use than were Asians and Hispanics; African Americans had the lowest prevalence rate. Although prevalence of current ST use was much higher among white than among non-white groups as a whole (17% *v* 11%), use of ST by non-whites in rural areas was much greater than that of non-whites in urban areas (22% *v* 6%) (data not shown in table 1). The odds ratio for current ST use associated with living in rural compared to urban areas was 4.25 (95% CI 2.17 to 8.36) for non-whites but only 1.06 (95% CI 0.71 to 1.57) for whites.

In addition, prevalence of current ST use was higher among current and former cigarette smokers than among those who never smoked (41% and 33%, respectively, versus 12%). ST use also was strongly associated with use of alcohol; players who drank alcohol were nine times more likely to use ST than non-drinkers (those who had had fewer than 10 drinks in the past year). In addition, the odds of ST use for players who perceived that their high school baseball coach or father used ST were three and four times higher, respectively, than for players who perceived that their coach or father did not use ST. Moreover, the odds of ST use for players who described their best friend as a regular user of ST was 22 times higher than for players who described their best friend as a non-user (table 1).

The prevalence of ST use was higher among those athletes who overestimated use of ST by teammates and by same age baseball athletes in general. It was also higher among those who

Table 1 Prevalence of current ST use\* overall and by demographic characteristics, other substance use, and significant others

	n	Prevalence (%)	OR (95% CI)
Overall	1226	15	
<i>Demographics</i>			
High school location			
Rural†	485	19	1.6 (1.2 to 2.3)
Urban	741	12	1.0
Ethnic group			
White	776	17	1.8 (1.2 to 2.6)
Non-white	443	11	1.0
Hispanic	258	11	
Asian	83	10	
African American	56	5	
Native American	38	18	
Age group			
> 16.5 to 19 years	612	17	1.5 (1.1 to 2.1)
13 to 16.5 years	599	12	1.0
<i>Substance use</i>			
Alcohol user			
Current use‡	547	29	9.6 (6.1 to 15.2)
No current use	678	4	1.0
Smoking history			
Current smoker§	46	41	5.3 (2.7 to 10.4)
Former smoker	122	33	3.7 (2.4 to 5.8)
Never smoked	1056	12	1.0
<i>Athlete's perception</i>			
Father uses ST			
Yes	88	36	3.8 (2.3 to 6.3)
No	1114	13	1.0
Coach uses ST			
Yes	517	22	3.1 (1.9 to 5.1)
No	403	11	1.4 (0.81 to 2.4)
Unknown	304	8	1.0
Best friend uses ST			
Regular	109	55	22.1 (13.3 to 36.8)
Occasional	214	36	9.9 (6.5 to 15.2)
Non-user	894	5	1.0

OR, odds ratio; CI, confidence interval; the category with OR = 1.0 is the reference category.

\*ST use more than once a month.

†Located in a town with a population < 50 000 in a county with a population density of < 1000 persons/square mile.

‡≥ 10 drinks consumed in the past 12 months.

§Daily use of at least 1 cigarette.

thought other players would still like them if they used ST, and among those who reported it was hard to say no when others tried to get them to use ST (table 2).

The prevalence of ST use was higher among those who were less likely to believe that ST use poses personal risks to their health (table 3). Compared with players who believed personal risk was likely, the odds ratios for current ST use were 3.6 for those who believed it was unlikely they would get mouth cancer, 4.2

Table 2 Prevalence of current ST use by social influence items

Item	n (%)	Prevalence of ST use (%)	OR (95% CI)
How many athletes on your team use ST?			
At least half	248 (20)	33	4.3 (3.0 to 6.1)
Less than half	972 (80)	10	1.0
In general, how many baseball athletes your age use ST?			
At least half	382 (31)	29	4.4 (3.1 to 6.1)
Less than half	836 (69)	9	1.0
Do you think people would like you if you used ST?			
Yes	758 (63)	19	2.7 (1.6 to 4.4)
No	175 (15)	8	1.0 (0.5 to 2.1)
Not sure	277 (22)	8	1.0
When people try to get you to use ST, is it hard to say no?			
Yes	52 (4)	46	36.0 (11.8 to 118)
Sometimes	137 (11)	39	27.3 (10.0 to 80.6)
No	809 (67)	12	5.5 (2.1 to 15.6)
No one ever tried	215 (18)	3	1.0

for those who believed it was unlikely they would get a sore mouth or throat, and 3.3 for those who believed it was unlikely they would get gum disease.

Prevalence of ST use also varied by knowledge about the effect of ST use on athletic performance and by knowledge about the fact that nicotine is addicting (table 3). Compared with players who knew the correct answers, the odds of using ST was higher among players who thought ST use improved athletic performance, and that nicotine was not addicting. In this study, knowing that nicotine is addicting and perceiving that ST use is likely to pose a risk of nicotine addiction were consistently associated with not using ST.

#### CHARACTERISTICS OF CURRENT USERS

Table 4 describes addiction related characteristics of ST users who were non-smokers by types of ST products used. Ninety two per cent of non-smoking athletes who used ST in our study sample (n = 147) reported using either snuff only (40%) or both snuff and chewing tobacco (52%), whereas 8% used chewing tobacco only. We found a trend consistent with a higher level of addiction among athletes who used both products compared to exclusive snuff users who in turn appeared to be more addicted to nicotine than those who used chewing tobacco exclusively. Small p values reject the null hypothesis that these three groups of ST users based on type of ST used are equal in the proportion of users who use ST year round, who had used for a year or more, who use on a daily basis, who use within three hours of waking, who have less confidence they could quit, who score themselves at higher levels on the 10 point subjective ST need scale, and who intend to use ST in the future.

#### REASONS FOR USE

Table 5 shows reasons users gave for using ST. Overall, the five most common reasons given were: having a strong craving; doing it without thinking too much about it; finding it satisfying and not having found a good substitute; boredom; and having friends who use it.

#### Discussion

We assessed the prevalence, patterns, and correlates of ST use among high school baseball athletes in California to determine a need for tobacco control interventions targeting this populations and to identify variables for use in planning such programs. We found that prevalence of current ST use among high school baseball players in California was 15% overall, and 19% and 13% respectively in rural and urban areas. Our findings for high school baseball athletes are much higher than the 2% reported in 1996 for teenage males in California who ever used ST,<sup>35</sup> and reflect the association of ST use with baseball. At least some of the observed difference in ST use among California teenage males in general and high school baseball athletes, however, is likely caused by differences in survey methodology. Data cited from the California tobacco surveys were from

Table 3 Prevalence of ST use by perceptions of self and of the likelihood of experiencing adverse health effects associated with ST use and knowledge related to ST use

Item	n (%)	Prevalence (%)	OR (95% CI)
<i>Perception of risk</i>			
It will give me a sore mouth or throat			
Slightly/very unlikely	328 (27)	30	4.2 (3.0 to 6.0)
Slightly/very likely	883 (73)	9	1.0
It would give me mouth cancer			
Slightly/very unlikely	146 (12)	34	3.6 (2.4 to 5.4)
Slightly/very likely	1067 (88)	12	1.0
It would give me gum disease			
Slightly/very unlikely	136 (11)	32	3.3 (2.2 to 5.0)
Slightly/very likely	1078 (89)	13	1.0
I would need surgery for oral cancer			
Slightly/very unlikely	448 (37)	19	1.6 (1.1 to 2.2)
Slightly/very likely	763 (63)	13	1.0
I would become addicted to ST			
Slightly/very unlikely	285 (23)	19	1.4 (1.0 to 2.1)
Slightly/very likely	927 (77)	14	1.0
<i>Knowledge</i>			
Using ST improves athletic performance			
True & don't know (incorrect)	160 (13)	24	2.0 (1.3 to 3.0)
False (correct)	1063 (87)	14	1.0
Nicotine is addicting			
False & don't know (incorrect)	131 (11)	21	1.6 (1.0 to 2.5)
True (correct)	1092 (89)	14	1.0

Table 4 Characteristics of ST users who were non-smokers by type of ST used

Characteristic	Chew only (n=12) %	Snuff only (n=59) %	Both (n=76) %	Exact 2-sided p value
Use pattern				
Year round	42	59	75	
Seasonal	58	41	25	0.0096*
Months of use				
> 12	25	32	46	
≤ 12	75	68	54	0.0648*
Frequency of use				
Daily	25	32	59	
Weekly	42	37	28	
Monthly	33	31	13	0.0007†
First use after waking				
≤ 3 hours	8	29	49	
> 3 hours	92	71	51	0.0013*
Perceived need (scale of 1-10)				
7-10 (high)	17	29	38	
4-6 (moderate)	42	32	36	
1-3 (low)	42	39	26	0.0670†
Future use				
Yes	50	62	71	
Maybe	17	19	20	
No	33	19	9	0.0368†
Quitting self efficacy				
Not at all	0	15	15	
A little	25	15	31	
Somewhat	8	27	19	
Very confident	67	42	36	0.0537‡

\*Trend; †linear-by-linear association; ‡Jonckheere-Terpstra test.

telephone based surveys.<sup>35</sup> In comparison, the present study employed a self completed questionnaire and collected saliva samples using a bogus pipeline procedure to increase validity for self report. There is some evidence to suggest that estimates of ST use can vary widely depending on the mode of data collection.<sup>26</sup> Nevertheless, regional data for adolescent males in general show that 3% to 36% use ST products regularly<sup>21 25 36-39</sup> and recent national data for high school males reports that 12% used ST within the last 30 days.<sup>20</sup> Although the more serious adverse health effects of ST use may be delayed for many years,<sup>1</sup> the early onset of ST use among young people provides time to build nicotine addiction and time for long term exposure to the high concentration of carcinogens in ST products. Findings from this study indicate that high school baseball athletes are at high risk for ST use and its negative health effects, and suggest the need

Table 5 Reasons for use identified as "important" by ST users

	All (n=131) %
It is satisfying and I have not found a good substitute	66
I have a strong craving for it	66
It helps me with boredom	64
My friends use it	64
I do it without thinking too much about it	64
Baseball season started again	55
I don't think it's as bad for my health as others may think	52
It helps me handle stress at school	34
I don't like withdrawal symptoms	30
I feel pressure to use from friends at school	23
It helps me handle problems in personal life	21
It helps me keep my weight down	21

for tobacco control programs for this population.

Despite reports that ST use is more common in rural areas and in small communities,<sup>38 40 41</sup> we found only a slightly higher prevalence of ST use among high school baseball athletes in rural compared to urban areas (19% v 13%). However, in our study, the excess ST use in rural areas appeared to be confined to minority groups. The prevalence of current ST use by non-white athletes at rural high schools was much greater than that of non-whites at urban high schools, whereas ST use among white athletes did not differ by rural/urban location. Our findings suggest that national data reporting that white male high school students are significantly more likely than non-white male high school students to use ST<sup>20</sup> may not apply to non-white high school baseball athletes in rural areas. Tobacco control programs targeting baseball athletes in rural areas should make use of non-white as well as white positive role models/spokespersons.

Our data indicate that reasons connected to nicotine addiction were consistently rated as important by ST users (table 5). The two reasons—"a strong craving for it" and "because it was satisfying and they had not found a good substitute"—were each considered important by 66% of ST users. This finding emphasises the need for interventions to interrupt the addiction process. In addition, 37% of these young ST using baseball athletes regularly used snuff exclusively, and 46% used both snuff and chewing tobacco. We found a trend based on addiction related variables indicating that athletes who used both snuff and chew tended to be more addicted to nicotine than those who used only snuff, who in turn tended to be more addicted than those who used only chewing tobacco (table 4). Although these findings should be interpreted with caution because of the small number of exclusive chewing tobacco users in our sample, it does appear that snuff users and combined product users are more physically dependent on nicotine and consequently may find it more difficult to quit the habit than chewing tobacco users. There are chemical and physical properties that account for the difference in addiction potential between chewing tobacco and most

forms of moist snuff. Higher serum cotinine concentrations have been reported in snuff users than in chewing tobacco users and have been attributed to the manner in which these products were used. Also, recent studies suggest that the products themselves have different nicotine dosing characteristics.<sup>42</sup> Nicotine addiction is a function of not just the quantity of nicotine extracted from the product, but also of the rate of delivery. In our study, 50% of current snuff users named Copenhagen or Kodiak as their usual brand. These high pH brands have higher concentrations of bioavailable nicotine and are associated with more rapid absorption of nicotine across oral mucosa. Therefore, they have a higher addiction potential than chewing tobacco which tends to be absorbed more slowly (even though chewing tobacco may contain the same or higher concentrations of nicotine than snuff).<sup>43</sup> Spit tobacco manufacturers intentionally control the concentration of bioavailable nicotine in their products through the addition of alkaline buffering agents. Manufacturers of ST advertise and promote the use of oral snuff starter products with low bioavailable nicotine as part of a graduation strategy that encourages young non-users to experiment with low nicotine starter brands and then graduate to brands with higher available nicotine as their nicotine addiction progresses.

Moreover, that use of snuff was much more common in this group of athletes than use of chewing tobacco is of concern because the strongest data associating the use of ST with oral lesions,<sup>2,3</sup> gingival recession,<sup>6</sup> and oral cancer<sup>1</sup> were obtained in snuff users.

A significant number of ST users in this study, however, did not know that nicotine was addicting, erroneously believed that ST use improved athletic performance, and perceived little personal risk of adverse health effects associated with their use of ST. Intervention programs are needed to correct these misconceptions. Chasin and colleagues<sup>44</sup> reported that among ST non-users the intention to use ST in the future was negatively related to the perceived health danger of using, and that chewing was perceived among adolescents as less dangerous than cigarettes by users of ST than by subjects who smoked or did neither. Increasing the perception of health risks from ST use may reduce use by young people.

Cigarette smoking in our entire sample of athletes was much lower (4%) than the national prevalence rate (29%) for high school males in the general population.<sup>20</sup> However, as with previous research,<sup>45</sup> there was a strong association among use of ST, cigarette smoking, and alcohol consumption in our study sample. This finding is a cause for special concern because ST and alcohol and/or cigarette use may have a synergistic effect on the development of oral cancer.<sup>46</sup> In addition, it suggests an addictive pattern of behaviour and the need to integrate intervention programs for these substances.<sup>47</sup>

In California all schools from kindergarten through to grade 12 are required to have a

tobacco free policy. That this policy has not eliminated ST use by some baseball athletes may reflect a lack of support from the coaches, through either negative role modelling or reticence to enforce the ban. Those athletes in our study who perceived that their coaches used ST tended to be more likely to use ST themselves. These findings suggest the need to provide effective in-service programs for high school baseball coaches to gain their support for policy level interventions targeting athletes, to promote positive role modeling, and to offer ST use cessation assistance. Levenson-Gingiss described a peer coaching program that incorporates strategies based on social learning theory and diffusion theory to influence teachers' perceptions of their work roles, capability to implement an innovative health program, and commitment to the new program.<sup>48</sup> Research is needed to examine the effect of such staff development programs on athletic coaches and subsequent use of ST by student athletes.

In this study, athletes whose fathers used ST were more likely to be ST users themselves than athletes whose fathers were non-users. This finding emphasises the importance of the father as a role model in influencing the ST use status of the son. Use of ST among adolescents has been reported to be related to family influence, especially that of the father.<sup>24-49-51</sup> Gottlieb and colleagues<sup>36</sup> found that athletes who did not intend to use ST perceived significantly less acceptance of ST use by important figures in their lives, and had a higher motivation to comply with the wishes of significant others than athletes who intended to use ST. Thus, involvement of significant others, such as coaches and fathers, in ST intervention programs could allow for establishment of important referents as environmental cues for and reinforcement of non-use.<sup>49-52</sup>

However, consistent with the findings of others,<sup>21-22-24-38-39-53-54</sup> we found peer influence, especially that of the best friend, to have the strongest association with ST use. Athletes in this study were 22 times more likely to use ST if their best friend used it. In addition, ST users also were more likely to perceive that they would be liked if they used ST and in general found it hard to say no in the face of social pressure to use. Only 18% of the athletes in our study reported that no one had ever tried to get them to use ST. Moreover, athletes who saw ST use as a social norm among their peers were more likely to be current users themselves. Twenty per cent of ST using athletes in this study perceived that ST was more commonly used by teammates and other same age baseball players than it actually is. Intervention programs targeting high school baseball athletes should highlight the fact that most do not use ST and should address conditions in the social environment that make them vulnerable to initiating ST use. It has been suggested that the effect of social influence on ST use behaviour is the direct and vicarious social reinforcement experienced by athletes as a result of receiving social approval, or of observing others receive approval, for using ST.<sup>55</sup>

Athletes in this study who found it hard to say no when offered ST were much more likely to use ST than athletes who did not find it hard to say no. Training in refusal skills may be an important part of ST prevention programs. Severson and colleagues<sup>56</sup> evaluated the efficacy of a school based refusal skills training prevention/cessation program among middle school and high school students (n = 1768). They found that the intervention reduced ST use among males, especially at the middle school level. Turner and Burciaga examined the effect of three components of current school based refusal assertion training on 93 junior high and high school students' ability to refuse tobacco use offers.<sup>57</sup> They found that teaching subjects various ways to say no and engaging them in the practice of refusal assertion led to improvement in role played skill to refuse tobacco offers and to a significant decrease in subjects' intention to use ST in the future. Elder and colleagues, on the other hand, reported that while tobacco refusal skills training alone did not produce a significant independent effect on tobacco use among high risk adolescents, it was an important component of comprehensive school based tobacco prevention programs.<sup>55</sup>

Changing the social norms that sanction and support ST use in the culture of baseball is essential. Use of peer leaders to endorse behavioural innovation in order to alter social norms have been used effectively in other research,<sup>58-60</sup> and should be considered in the development of ST use interventions as well. In addition, enlisting the support of well known non-using professional players, as suggested by Gottlieb and colleagues,<sup>49</sup> or of college athletes who have struggled either with quitting use of ST or with the temptation to begin using ST, might influence social norms to support non-use. Such presentations would reinforce player decisions not to use and provide external cues to motivate current users to stop. Programs targeting ST use among professional baseball athletes (such as Oral Health America's NSTEP led by Joe Garagiola, former major leaguer and Hall of Fame broadcaster) are also extremely important because high profile baseball athletes are potent role models for youth, especially young baseball players.

The big challenge, however, is to discover effective strategies to convince this adolescent population of their personal vulnerability to health risks associated with ST use and at the same time to override what they see as the positive aspects, including the approval of their male peers. Such a program might include documentation of the cynical exploitation of their age group by the tobacco companies; full disclosure of the many poisonous substances in tobacco to which they are being exposed, especially the extra harmful effects of snuff; and the potential risk of substituting addiction to smoking cigarettes and/or drinking alcohol when trying to quit ST use. Also, since over 60% of ST using baseball and football athletes in our previous college study said they would be motivated to quit by seeing harmful changes

in their own mouth or by receiving advice to quit from a dentist,<sup>17</sup> enlisting dental professionals to point out tobacco related lesions in the players' mouth or in intraoral photographs of other athletes and to offer cessation advice might be effective components of such a program for high school baseball athletes. To date, effective intervention programs reported for ST cessation among college athletes<sup>61</sup> and other adults<sup>62</sup> have used oral exams with feedback about ST associated oral lesions and brief cessation counselling. It is important that those ST users who indicate they want to quit are provided with knowledge and skills needed to get ready to quit, to cope with cravings and triggers for use, and to use nicotine replacement therapy to reduce nicotine withdrawal symptoms if necessary. A self help guide for quitting ST use that is tailored to baseball athletes is available from the National Cancer Institute and could be a valuable adjunct to such individual counselling efforts.<sup>63</sup>

In summary, our findings indicate that considerable experimentation with ST products occurs among high school baseball athletes in California, and many are using ST regularly. ST interventions targeting this population represent an important opportunity to stop the transition from experimental ST use to tobacco dependence, especially in rural areas.

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