

Smokeless tobacco brand preference and brand switching among US adolescents and young adults

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Abstract

Objectives – To describe the brand preference of young smokeless tobacco users in the US; to examine how this may change with duration, frequency, and intensity of use; and to examine self-reported difficulty in quitting as a reason for use, and indicators of nicotine withdrawal in relation to specific smokeless tobacco brands.

Design – Cross-sectional study from the 1993 Teenage Attitudes and Practices Survey (TAPS) and follow-up study from the 1989 TAPS.

Setting – Population surveys, US.

Subjects – Cross-sectional study: 282 subjects aged 10–22 years who used smokeless tobacco and bought their own, and did not smoke on more than five of the preceding 30 days; follow-up study: 83 subjects who used smokeless tobacco at baseline and follow up, reported buying their own smokeless tobacco at both surveys, and were not concurrent smokers.

Results – The moist snuff brands Skoal, Copenhagen, Kodiak, and Skoal Bandits accounted for 80% of the smokeless tobacco products purchased by young people. The likelihood of choosing Copenhagen increased with increasing duration, frequency, and intensity of smokeless tobacco use. Copenhagen and Kodiak users were more likely than users of Skoal Bandits or Skoal to report using smokeless tobacco because it was difficult to quit, and were more likely to report nicotine withdrawal symptoms. Among persons who used Skoal or Skoal Bandits at baseline, 50% still used those brands at follow up and 31% had switched to Copenhagen; 83% of persons who usually bought Copenhagen at baseline were still using it at follow up, and 17% had switched to Skoal or Skoal Bandits.

Conclusions – This study is consistent with the hypothesis that snuff users initially use brands with low nicotine dosage, and then switch to high nicotine dosage brands, particularly Copenhagen. Young smokeless tobacco users were disproportionately likely to choose moist snuff, paralleling the marketing and advertising strategies of manufacturers.

The higher rate of withdrawal symptoms and difficulty quitting reported among users of Copenhagen and Kodiak suggests that these brands may deliver nicotine more readily than Skoal or Skoal Bandits.

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Keywords: smokeless tobacco; brand preference; adolescents

Introduction

The use of smokeless tobacco, which includes both snuff and chewing tobacco varieties, has been established as a cause of oral cancer and nicotine addiction in human populations, and has been associated with irreversible gingival recession and other oral pathologies.¹ Recent evidence suggests that smokeless tobacco users may be at increased risk of death from cardiovascular diseases.² Yet, in the face of mounting evidence of these adverse health risks, a considerable proportion of young people perceive that smokeless tobacco products are safe and socially acceptable.³

Despite attempts to prevent the use of smokeless tobacco through education, warning labels on smokeless tobacco packaging, and the prohibition of smokeless tobacco advertising on radio and television,⁴ smokeless tobacco use continues to be a public health problem in the US. Use of smokeless tobacco among young men 18–24 years old increased from 2.2% in 1970 to 8.4% in 1991, an increase of nearly 300%,⁵ and consumption of moist snuff in the US has increased every year since 1979.⁶ Recent school-based surveys have estimated that 19.7% of US male high school seniors (unpublished data, Institute for Social Research, University of Michigan, 1993 Monitoring the Future Project) and 19.2% of male high school students (most of whom are 14–18 years of age) currently use smokeless tobacco.⁷ A 1992 national household-based survey of US children found that 11.9% of males 12–17 years of age were using smokeless tobacco (Centers for Disease Control and Prevention (CDC), Division of Adolescent and School Health, unpublished data from the 1992 Youth Risk Behavior Survey supplement to the National Health Interview Survey). Among high school seniors who had ever tried smokeless tobacco, 73% did so by the ninth grade (age 14).⁸

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Information indicating that the dominant manufacturer of moist snuff designed the marketing campaign for its brands around a graduation strategy to involve new users^{8,9} and data on the orderly differences in free (unprotonated) nicotine among these products^{10,11} prompted us to examine brand use patterns of smokeless tobacco among young people surveyed in an epidemiological study of tobacco use in adolescents and young adults.

The purposes of this study were to describe the brand preference of young smokeless tobacco users in the US; to examine how this preference may change with increased duration, frequency, and intensity of smokeless tobacco use; and to examine difficulty in quitting as a reason for use, and reported withdrawal symptoms on previous attempts to quit in relation to the specific smokeless tobacco brand usually used.

Methods

Cross-sectional data for this study are from the 1993 Teenage Attitudes and Practices Survey (TAPS-II), conducted by the CDC's National Center for Health Statistics and Office on Smoking and Health. Data on knowledge, attitudes, and practices regarding tobacco use were collected by telephone interviews; people who could not be contacted by telephone were contacted in person. The TAPS-II sample for this analysis had two components: (a) of the 9135 respondents (aged 12–18 years) to the 1989 TAPS telephone interview, 7960 (87.1%) participated in TAPS-II (these respondents were aged 15–22 years in 1993); and (b) an additional 4992 persons from a new probability sample of 5590 persons aged 10–15 years (89.3% response rate) participated in TAPS-II. The data from the two sample components were combined for a total sample size of 12 952, the data were weighted to provide US national estimates, and 95% confidence intervals were calculated by using the standard errors estimated by SUDAAN.¹²

People who had used smokeless tobacco on at least one day in the 30 days preceding the survey ($n = 471$; 3.2% [weighted]) were asked whether they usually bought their own chewing tobacco or snuff. Those who reported that they bought their own chewing tobacco or snuff ($n = 395$) were asked which brand they usually bought. Persons who had ever used smokeless tobacco were asked on how many days of the 30 days preceding the survey they used it (frequency), and how many times per day they used smokeless tobacco on the days they used it (intensity). Duration of smokeless tobacco use was defined as the number of elapsed years between a respondent's age at the time of the survey and the reported age at which he or she first started using chewing tobacco or snuff.

To see how brand preference of snuff might change with experience of the user, we analysed the brand of snuff usually purchased by reported duration, frequency, and intensity of use. To obtain stable estimates, the varieties

Skoal and Skoal Bandits (moist snuff in sachets) were combined. People who reported that they smoked cigarettes on more than five of the preceding 30 days ($n = 113$; 28.2% [weighted]) of current smokeless tobacco users) were excluded from analysis to control for other sources of nicotine exposure that might influence the pattern of smokeless tobacco use or brand preference.

Those who used smokeless tobacco during the 30 days preceding the survey were asked whether they used it because "it's really hard to quit"; an affirmative answer indicates an influence of the addictive properties of nicotine.¹³ Those who used smokeless tobacco and reported that they tried to quit were asked "When you tried to quit using chewing tobacco or snuff did you feel a strong need or urge to use it again; feel more irritable; find it hard to concentrate; feel restless; feel hungry more often; feel sad, 'blue', or depressed?". These symptoms are considered indicators of the nicotine withdrawal syndrome.^{3,14}

Confidence intervals for proportions were interpreted as the range that included the true proportion in the underlying population, with a 95% probability¹⁵; confidence intervals that did not overlap were consistent with a statistically significant difference between proportions. Independence between two variables was tested using the χ^2 test for survey data calculated by SUDAAN, which is analogous to the Pearson χ^2 test for non-survey data.¹² We used multiple logistic regression modelling to simultaneously control for several covariates in examining the relationship between respondents' usual brand of smokeless tobacco and symptoms of nicotine addiction and withdrawal.^{12,16}

To characterise the natural history of brand preference and brand switching among snuff users, we analysed follow-up data on respondents to TAPS who reported current use of smokeless tobacco at the time of the baseline interview, and reported that they were current users in TAPS-II. To control for other sources of nicotine that might confound brand preference and patterns of smokeless tobacco use, persons who smoked cigarettes on more than five of the preceding 30 days at either baseline and follow-up surveys were excluded from analysis. Eighty-three people were included in the longitudinal analysis. Because valid statistical weighting was not available for the panel survey participants, due to differential loss to follow up of tobacco users, unweighted data were used and no formal statistical tests were performed.

Results

Skoal, Copenhagen, and Kodiak were the most popular brands of smokeless tobacco products purchased by those aged 10–22 years in the US in 1993 (table 1). These brands of moist snuff and Skoal Bandits accounted for 80% of the smokeless tobacco products bought by young people. In comparison, the prevalence of chewing tobacco use and snuff use were nearly equal among the US adult population in 1991.⁵

Table 1 Percentage* distribution of snuff and chewing tobacco brands bought by current smokeless tobacco users† aged 10–22 years who reported usually buying their own smokeless tobacco products, by selected characteristics – US, Teenage Attitudes and Practices Survey – II, 1993

Characteristic	No	Skoal Bandits % (95% CI)	Skoal % (95% CI)	Copenhagen % (95% CI)	Kodiak % (95% CI)	Red Man % (95% CI)	Levi Garrett % (95% CI)	Beechnut % (95% CI)	Other/ No usual % (95% CI)
Age (years)									
10–17	120	4.7 (±4.2)	33.1 (±9.1)	20.3 (±8.6)	16.0 (±6.4)	11.2 (±6.8)	4.2 (±3.6)	2.7 (±2.9)	7.8 (±5.1)
18–20	186	6.1 (±4.7)	34.4 (±7.3)	30.9 (±7.6)	13.1 (±4.7)	4.1 (±3.4)	5.7 (±3.2)	0	5.7 (±3.1)
21–22	89	4.5 (±4.0)	26.6 (±9.8)	35.1 (±9.8)	14.0 (±7.6)	4.8 (±3.9)	1.2 (±2.4)	5.4 (±5.3)	9.9 (±5.1)
Region‡									
Northeast	48	5.6 (±5.9)	38.4 (±16.0)	25.1 (±12.2)	19.5 (±14.6)	7.1 (±10.0)	2.0 (±3.8)	2.2 (±4.4)	0
Midwest	119	1.8 (±2.5)	31.4 (±9.9)	19.9 (±8.8)	32.7 (±9.1)	2.2 (±2.6)	0.8 (±1.6)	1.0 (±1.9)	10.1 (±5.1)
South	175	7.6 (±5.0)	30.6 (±7.3)	32.8 (±9.2)	4.4 (±2.9)	8.8 (±4.7)	6.2 (±3.4)	1.9 (±2.2)	7.7 (±3.8)
West	53	3.6 (±4.7)	34.6 (±13.9)	32.3 (±12.8)	10.4 (±7.8)	5.6 (±5.7)	5.2 (±5.9)	4.0 (±5.2)	4.3 (±5.8)
Family income									
< \$25000	100	7.3 (±7.8)	34.9 (±10.9)	25.5 (±9.1)	15.5 (±7.3)	7.1 (±6.9)	3.7 (±3.4)	1.2 (±2.2)	4.9 (±4.9)
\$25K–\$49999	165	5.3 (±3.7)	29.8 (±7.9)	33.3 (±8.2)	12.5 (±5.2)	4.1 (±2.9)	3.6 (±2.8)	3.5 (±3.0)	7.9 (±3.8)
≥ \$50000	75	3.7 (±4.0)	29.6 (±10.9)	27.7 (±10.5)	18.3 (±9.0)	8.8 (±7.6)	5.4 (±5.2)	1.4 (±2.6)	5.3 (±5.1)
Unknown	55	3.7 (±5.1)	39.5 (±13.3)	20.9 (±10.6)	10.5 (±7.9)	9.1 (±7.5)	5.7 (±6.2)	0	10.6 (±8.7)
Residence									
Urban	244	6.8 (±3.9)	28.5 (±6.2)	28.2 (±5.9)	16.4 (±5.1)	9.1 (±4.1)	5.2 (±2.7)	1.3 (±1.4)	4.6 (±2.6)
Rural	151	2.7 (±3.0)	39.0 (±9.0)	29.2 (±11.2)	10.3 (±4.9)	1.9 (±2.3)	2.6 (±2.6)	3.3 (±3.2)	11.1 (±4.9)
Total	395	5.3 (±2.7)	32.3 (±5.2)	28.6 (±5.6)	14.2 (±3.8)	6.4 (±2.8)	4.2 (±2.0)	2.0 (±1.5)	6.9 (±2.4)

* Percentages and confidence intervals are based on weighted data.

† Respondents who reported using snuff or chewing tobacco on one or more of the 30 days preceding the survey.

‡ Northeast = Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; Midwest = Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; South = Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; and West = Alaska, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

CI = Confidence interval.

Because nearly all current users of smokeless tobacco were males (98.3%) and non-Hispanic whites (94.7%), data on brand preference are not presented by sex or race/ethnicity. When brand preference was examined by age group, smokeless tobacco users aged 21–22 years were 77% more likely to choose Copenhagen than were users aged 10–17 years; however, the confidence intervals for these estimated proportions overlapped because of the relatively small sample sizes. Kodiak was most popular in the Midwest, a region where Copenhagen tended to be less preferred than in the other three geographical regions of the US. There were no clear patterns of brand preference by reported family income. Current smokeless tobacco users living in urban areas were more likely to prefer Skoal Bandits, Kodiak, and Red Man than users residing in rural areas.

Current smokeless tobacco users who had used smokeless tobacco for four years or longer were about three times more likely to purchase Copenhagen than those who used smokeless tobacco for one year or less (table 2). The percentage of smokeless tobacco users who bought the other brands included in this analysis decreased with increasing duration of use. Similarly, as smokeless tobacco users reported more frequent or intensive use, they were more likely to report usually buying Copenhagen. For example, those who reported that they used smokeless tobacco on every one of the preceding 30 days were 2.7 times more likely than people using it on 1–14 days to choose Copenhagen (42.4% vs 15.5%).

Bivariate analyses on symptoms of nicotine addiction and the nicotine withdrawal syndrome were conducted for all current smokeless tobacco users, and for current users who did not smoke (table 3). People who reported that they usually bought Copenhagen were more likely to report that they used snuff because it was difficult to quit than users of Skoal or Skoal Bandits. Among those who used smokeless tobacco and reported that they had tried to quit, those who usually bought Copenhagen were more likely to report one or more indicators of nicotine withdrawal than those who usually bought Skoal or Skoal Bandits. People who usually bought Kodiak tended to be more likely to cite difficulty quitting as a reason for use and tended to be more likely to report a withdrawal symptom than users of Skoal or Skoal Bandits, but the confidence intervals for these estimated percentages overlapped. For all brands, the percentage reporting difficulty quitting or a symptom of nicotine addiction on previous attempts to quit smokeless tobacco use was higher when those who smoked on more than five days of the preceding 30 were excluded from analysis, compared with estimates for all smokeless tobacco users. This difference was most pro-

Table 2 Percentage* distribution of smokeless tobacco brands usually bought by current users† aged 10–22 years who buy their own smokeless tobacco, by duration, frequency, and intensity of use – US, Teenage Attitudes and Practices Survey, 1993

Use	No	Usual brand			
		Skoal Bandits/ Skoal % (95% CI)	Copenhagen % (95% CI)	Kodiak % (95% CI)	Other‡ % (95% CI)
Duration§ (years)					
≤ 1	54	40.5 (±13.5)	12.5 (±8.7)	21.0 (±11.1)	26.0 (±13.5)
2–3	66	36.4 (±11.9)	25.5 (±10.7)	15.6 (±8.2)	22.5 (±10.4)
≥ 4	150	33.9 (±8.3)	36.9 (±9.2)	9.3 (±4.7)	19.9 (±6.5)
Frequency (days)					
1–14	100	35.5 (±9.8)	15.5 (±6.9)	15.1 (±7.6)	33.9 (±9.6)
15–29	53	37.5 (±14.1)	20.2 (±10.9)	15.9 (±10.1)	26.3 (±13.9)
30	128	34.7 (±9.3)	42.4 (±10.2)	11.7 (±5.5)	11.3 (±5.6)
Intensity¶ (//day)					
1–2	119	38.8 (±9.2)	15.3 (±6.8)	11.3 (±5.3)	34.7 (±9.0)
≥ 3	156	32.9 (±8.3)	38.4 (±8.9)	15.4 (±6.1)	13.2 (±5.1)

* Percentages and confidence intervals are based on weighted data.

† Used snuff at least once in the preceding 30 days. Persons who smoked cigarettes on more than five of the 30 days preceding the survey were excluded from analysis.

‡ Includes Red Man, Levi Garrett, Beechnut, other, and no usual brand.

§ Number of years used, based on age at time of interview and self-reported age when first started using. $\chi^2 = 12.9$, degrees of freedom (df) = 6; $p = 0.06$.

|| Days used during preceding 30 days. $\chi^2 = 18.3$, df = 6; $p = 0.01$.

¶ Times used per day. $\chi^2 = 17.8$, df = 3; $p = 0.001$.

CI = Confidence interval.

Table 3 Percentage* of snuff users† aged 10–22 years who reported that difficulty quitting was a reason for use or who experienced symptoms of nicotine withdrawal‡ during previous attempts to discontinue use, by snuff brand usually bought – US, Teenage Attitudes and Practices Survey, 1993

	"It's really hard to quit"			Any symptom of withdrawal		
	n	% (95% CI)	p§	n	% (95% CI)	p§
All subjects (brand)						
Skoal/Skoal Bandits	141	35.7 (±7.8)		87	60.1 (±11.6)	
Copenhagen	115	56.4 (±8.8)		73	83.2 (±8.2)	
Kodiak	61	49.9 (±11.5)		29	77.5 (±14.1)	
Other	73	24.1 (±9.3)		29	56.9 (±17.1)	
Total	390	41.4 (±5.0)	0.0009	218	69.3 (±6.4)	0.02
Excluding current smokers¶ (brand)						
Skoal/Skoal Bandits	93	44.9 (±10.3)		59	74.7 (±11.6)	
Copenhagen	83	62.6 (±10.3)		58	85.4 (±9.3)	
Kodiak	42	55.3 (±13.7)		24	80.5 (±15.7)	
Other	59	26.2 (±10.8)		25	62.1 (±18.4)	
Total	277	47.3 (±6.0)	0.004	166	77.2 (±6.6)	0.27

* Percentages and confidence intervals are based on weighted data.

† Used snuff at least once or more during the preceding 30 days.

‡ Current snuff users who responded "yes" to at least one of the following indicators: found it hard to concentrate, felt hungry more often, felt more irritable, felt strong need/urge to chew, felt restless, or felt sad, "blue", or depressed.

§ χ^2 test for independence of two variables.

|| Includes Red Man, Levi Garrett, Beechnut, other, and no usual brand.

¶ Persons who smoked cigarettes on more than five of the 30 days preceding the survey were excluded from analysis.

CI = confidence interval.

Table 4 Odds ratio (OR) estimates for reported difficulty quitting as a reason for smokeless tobacco use, multiple logistic regression modelling* – US, Teenage Attitudes and Practices Survey, 1993

Use	Model 1	Model 2	Model 3
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Brand			
Skoal/Skoal Bandits	1.0 (referent)	1.0 (referent)	1.0 (referent)
Copenhagen	1.7 (0.9, 3.3)	1.6 (0.8, 3.2)	1.3 (0.6, 2.8)
Kodiak	2.1 (1.0, 4.4)	2.6 (1.2, 5.7)	2.1 (0.9, 4.8)
Other†	0.7 (0.3, 1.5)	0.7 (0.3, 1.5)	0.7 (0.3, 1.5)
Frequency‡ (days)			
1–14	1.0 (referent)	1.0 (referent)	1.0 (referent)
15–29	3.8 (1.8, 8.0)	3.6 (1.7, 7.7)	2.8 (1.2, 6.7)
30	12.6 (6.4, 24.6)	9.1 (4.5, 18.3)	6.0 (2.5, 14.3)
Duration§ (years)			
≤ 1	NA	1.0 (referent)	1.0 (referent)
2–3	NA	2.1 (0.8, 5.6)	2.2 (0.8, 5.6)
≥ 4	NA	3.1 (1.3, 7.7)	2.8 (1.2, 6.8)
Intensity (/day)			
1–2	NA	NA	1.0 (referent)
≥ 3	NA	NA	2.0 (0.9, 4.3)

* Persons who smoked cigarettes on more than five of the 30 days preceding the survey were excluded from analysis.

† Includes Red Man, Levi Garrett, Beechnut, other, and no usual brand.

‡ Days used during preceding 30 days.

§ Number of years used, based on age at time of interview and self-reported age when first started using.

CI = Confidence interval; NA = not applicable.

nounced among users of Skoal and Skoal Bandits, 43.3% of whom had smoked on more than five of the preceding 30 days. In comparison, 28% of Copenhagen users, 16% of Kodiak users, and 13% of persons using other brands had smoked cigarettes on more than five of the preceding 30 days.

In logistic regression modelling of self-reported difficulty quitting smokeless tobacco, the strongest predictor was reported frequency of use in the preceding 30 days (table 4). Controlling for frequency of use (Model 1), users of Copenhagen and Kodiak tended to be more likely to report difficulty quitting than users of Skoal or Skoal Bandits, although the lower confidence limit of the odds ratio estimate for Copenhagen was just below unity.

Controlling for duration and frequency of use (Model 2), users of Kodiak were significantly more likely than users of Skoal or Skoal Bandit to report difficulty quitting as a reason for use, and the estimate for Copenhagen was attenuated slightly. Simultaneously controlling for usual brand and duration, frequency, and intensity of use (Model 3), the estimated odds ratios for Copenhagen and Kodiak were attenuated. Although the confidence intervals for the risk estimates for these brands in Model 3 preclude firm conclusions of statistical significance, the risk estimates were consistent with an increased likelihood of reporting difficulty quitting as a reason for use, and with a magnitude of effect similar to increased duration and intensity of use. Multiple logistic regression modelling for withdrawal symptoms found a significant effect only for frequency and intensity of use; although longer duration of use and use of Copenhagen tended to infer increased risk, the models were based on small sample sizes and produced large standard errors for parameter estimates.

In the follow-up analysis, 26 people reported at baseline that they usually bought Skoal or Skoal Bandits. At the follow-up interview, 13 (50%) of these reported that they still purchased these brands, eight (31%) reported that they bought Copenhagen, and five (19%) reported that they used another brand of smokeless tobacco. Among the 29 people who reported at baseline that they usually bought Copenhagen, 24 (83%) were still buying Copenhagen at the time of follow-up interview; five (17%) had switched to Skoal or Skoal Bandits.

Discussion

This report presents the first published US national data on brand preference among

adolescent and young adult users of smokeless tobacco. The strong preference for moist snuff varieties among young users, compared with the general adult population in the US, parallels industry marketing and advertising activities.^{17,18} A similar pattern of brand preference among young people in relation to marketing and advertising expenditures has been described for cigarettes.¹⁹

The findings in this study support the hypothesis of a "graduation" of snuff users from varieties with lower levels of free nicotine to those with higher levels among users of products manufactured by the US Tobacco Company, the producer of 84% of the moist snuff sold in the US.²⁰ Based on the work of Henningfield *et al*¹⁰ and Djordjevic *et al*,¹¹ Skoal Bandits may be categorised as providing a low level of free nicotine, most Skoal varieties may be considered to be medium or medium-high level delivery systems, and Copenhagen may be categorised as delivering a high level of free nicotine. Kodiak, manufactured by the Conwood Tobacco Company, was also classified as a high nicotine level delivery system.¹¹ The percentage of snuff users who bought Skoal or Skoal Bandits tended to decrease with increasing duration, frequency, and intensity of use. Conversely, the proportion of snuff users who chose Copenhagen was about three times higher among those who used snuff for four years or more than among those who used snuff for one year or less, and was higher among those who used smokeless tobacco more frequently and with increased intensity. This pattern of brand preference probably reflects a progression of nicotine addiction and the need to increase nicotine intake to maintain the same physiological and psychological effects (chronic tolerance).^{1,21} Smokeless tobacco users may increase the frequency and intensity with which they use these products as their tolerance to nicotine progresses, and they may also choose to switch to brands that deliver a higher level of free nicotine.

Although the longitudinal data analysis was based on a small number of subjects, the findings are consistent with this hypothesis of brand switching. Only a half of those who used Skoal or Skoal Bandits at the time of the baseline survey were still using the same brands approximately four years later; nearly a third had switched to Copenhagen. Among people who used Copenhagen at baseline, 83% were still buying it at follow up. This pattern suggests that a considerable proportion of young people who continue using smokeless tobacco over a period of years may switch from brands with a low or medium level of free nicotine to brands with a high level, but a much smaller proportion of people already using a brand with a high level of free nicotine may switch to a brand with a lower level.

The pattern of self-reported difficulty in quitting and symptoms of nicotine withdrawal on previous quit attempts among users of the most popular brands of snuff are consistent with the ranking of free nicotine levels reported by Henningfield *et al*¹⁰ and Djordjevic *et al*.¹¹ Persons who used Kodiak or Copenhagen

tended to be more likely than users of Skoal Bandits or Skoal to report difficulty quitting smokeless tobacco use, even after controlling for duration, frequency, and intensity of smokeless tobacco use.

Smokeless tobacco users who did not smoke cigarettes on more than five of the preceding 30 days were generally more likely than concurrent smokers to report difficulty quitting smokeless tobacco use or had symptoms of the nicotine withdrawal syndrome. This suggests that smokeless tobacco users who also smoke may be able to supplement their nicotine intake with cigarettes to avoid withdrawal symptoms or to facilitate quitting smokeless tobacco use. Because more than a quarter of smokeless tobacco users also smoked on more than five of the preceding 30 days, interventions for both smoking and smokeless tobacco use should address all sources of nicotine intake.

Regional differences in brand preference for smokeless tobacco suggest that other factors may influence the purchasing behaviour of young people, such as advertising and marketing strategies. Further research is needed on regional differences in marketing smokeless tobacco products, and how these marketing strategies impact on young people.

One limitation in this study is that most of the findings are based on cross-sectional analysis. Caution must be exercised in inferring brand preference and brand switching in relation to progression of nicotine addiction when using this study design. Although the longitudinal analysis was consistent with the "graduation" hypothesis, the small sample size precluded a more in-depth analysis of the natural history of smokeless tobacco use in young people.

Another limitation in this study is the way data on smokeless tobacco brands were collected. Users of smokeless tobacco who bought their own products were asked only the brand (for example, Skoal), but not the variety of smokeless tobacco (such as flavoured *vs* plain, or long cut *vs* fine cut). Differences in brand variety can influence both the acceptability of these products to new users and the levels of unprotonated nicotine, but we were unable to explore the pattern of use in relation to these other factors.

Analysis of the original TAPS sample by smoking status at the time of the 1989 interview revealed that youth who were successfully followed up in TAPS-II were less likely to have reported smoking than those who could not be re-interviewed (CDC, unpublished data). TAPS respondents who lived in households without telephones (and were therefore not eligible for the TAPS-II interview) may have been more likely to be smokers. Although this analysis was not conducted for status of TAPS smokeless tobacco use, it is likely that a similar differential response may have occurred. For these reasons, prevalence estimates of tobacco use from TAPS-II may be lower than they would have been, had the entire TAPS-I cohort been re-interviewed, and they must be interpreted

with caution. To the extent that the smokeless tobacco pattern of use and brand preference differed between responders and non-responders to TAPS-II, bias may have been introduced.

In conclusion, it appears that young smokeless tobacco users in the US are far more likely to use moist snuff than other forms of smokeless tobacco, in contrast with the nearly equal prevalence of snuff and chewing tobacco use among adults. This pattern parallels the marketing and advertising activities of smokeless tobacco manufacturers. The findings in this study support the hypothesis that snuff users in earlier stages of tobacco use and nicotine addiction, use brands with low levels of free nicotine, and then "graduate" to brands with high levels, particularly Copenhagen. The reported symptoms of nicotine addiction and withdrawal are consistent with recent reports on the rank order of free nicotine levels of specific brands of smokeless tobacco.

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- 1 US Department of Health and Human Services. *The health consequences of using smokeless tobacco. A report of the advisory committee to the Surgeon General, 1986*. Bethesda, Maryland: Public Health Service, National Institutes of Health, 1986. (NIH Publication No 86-2874.)
- 2 Bolinder G, Alfredsson L, Englund A, de Faire U. Smokeless tobacco use and increased cardiovascular mortality among Swedish construction workers. *Am J Public Health* 1994; 84: 399-404.
- 3 US Department of Health and Human Services. *Preventing tobacco use among young people. A report of the Surgeon General, 1994*. Atlanta, Georgia: Public Health Service, Centers for Disease Control and Prevention, Office on Smoking and Health, 1994. (US Government Printing Office Publication No S/N 017-001-00491-0.)
- 4 US Department of Health and Human Services. *Reducing the health consequences of smoking: 25 years of progress. A report of the Surgeon General, 1989*. Rockville, Maryland: Public Health Service, Centers for Disease Control, Office on Smoking and Health, 1989. (DHHS Publication No (CDC)89-8411.)
- 5 Giovino GA, Schooley MW, Zhu BP, et al. Surveillance for selected tobacco-use behaviors - United States, 1900-1994. *MMWR* 1994; 43(SS-3): 1-43.
- 6 Creek L, Capehart T, Grise V. *US tobacco statistics, 1935-92*. Commodity Economics Division, Economic Research Service, US Department of Agriculture, 1994. Statistical Bulletin No 869.
- 7 Kann L, Warren W, Collins JL, Ross J, Collins B, Kolbe LJ. Results from the national school-based 1991 Youth Risk Behavior Survey and progress toward achieving related health objectives for the nation. *Public Health Rep* 1993; 108 (suppl 1): 47-55.
- 8 Marsee v. United States Tobacco Company, 639 F Suppl 466 (WD Okla 1986) aff'd, 866 F 2d 319 (10th Cir 1989).
- 9 Connolly GN. The marketing of nicotine addiction by one oral snuff manufacturer. *Tobacco Control* 1995; 4: 73-9.
- 10 Henningfield JE, Radzius A, Cone EJ. Estimation of available nicotine content of six smokeless tobacco products. *Tobacco Control* 1995; 4: 57-61.
- 11 Djordjevic MV, Hoffmann D, Glynn T, Connolly GN. US commercial brands of moist snuff, 1994. I. Assessment of nicotine, moisture, and pH. *Tobacco Control* 1995; 4: 62-6.
- 12 Shah BV, Barnwell BG, Beth G, Hunt PN, LaVange LM. *SUDAAN user's manual, release 5.5*. Research Triangle Park, North Carolina: Research Triangle Institute, 1991.
- 13 US Department of Health and Human Services. *The health consequences of smoking: nicotine addiction. A report of the Surgeon General, 1988*. Rockville, Maryland: Public Health Service, Centers for Disease Control, 1988. (DHHS Publication No (CDC) 88-8406.)
- 14 McNeill AD, West RJ, Jarvis M, Jackson P, Bryant A. Cigarette withdrawal symptoms in adolescent smokers. *Psychopharmacology* 1986; 90: 533-6.
- 15 Rothman KJ. *Modern epidemiology*. Boston, Massachusetts: Little, Brown, and Company, 1986.
- 16 Hosmer DW, Lemeshow S. *Applied logistic regression*. New York, New York: John Wiley & Sons, 1989.
- 17 Freedman AM. How a tobacco giant doctors snuff brands to boost their 'kick'. *Wall Street J* 1994 October 26.
- 18 US Federal Trade Commission. *Report to Congress pursuant to the Smokeless Tobacco Health Education Act of 1986*. Washington, DC: Federal Trade Commission, 1993.
- 19 US Centers for Disease Control and Prevention. Changes in the cigarette brand preferences of adolescent smokers - United States, 1989-1993. *MMWR* 1994; 43: 577-81.
- 20 Maxwell JC. The Maxwell Report: USA-Smokeless. Glimmer: moist snuff remains only smokeless category showing growth. *Tobacco Reporter* 1994; 121: 18-22.
- 21 Henningfield JE, Cohen C, Pickworth WB. *Psychopharmacology of nicotine*. In: Orleans CT, Slade J, eds. *Nicotine addiction: principles and management*. New York: Oxford University Press, 1993.