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Tobacco use transitions in the United States: The National Longitudinal Study of Adolescent Health

Annette R. Kaufman^{a,*}, Stephanie Land^a, Mark Parascandola^a, Erik Augustson^a, and Cathy L. Backinger^b

^aTobacco Control Research Branch, National Cancer Institute, Rockville, MD, United States

^bCenter for Tobacco Products, Food and Drug Administration, Silver Spring, MD, United States

Abstract

Objectives—The purpose of this study is to evaluate and describe transitions in cigarette and smokeless tobacco (ST) use, including dual use, prospectively from adolescence into young adulthood.

Methods—The current study utilizes four waves of the National Longitudinal Study of Adolescent Health (Add Health) to examine patterns of cigarette and ST use (within 30 days of survey) over time among a cohort in the United States beginning in 7th–12th grade (1995) into young adulthood (2008–2009). Transition probabilities were estimated using Markov modeling.

Results—Among the cohort ($N = 20,774$), 48.7% reported using cigarettes, 12.8% reported using ST, and 7.2% reported dual use (cigarettes and ST in the same wave) in at least one wave. In general, the risk for transitioning between cigarettes and ST was higher for males and those who were older. Dual users exhibited a high probability (81%) of continuing dual use over time.

Conclusions—Findings suggest that adolescents who use multiple tobacco products are likely to continue such use as they move into young adulthood. When addressing tobacco use among adolescents and young adults, multiple forms of tobacco use should be considered.

*Corresponding author at: Tobacco Control Research Branch, Behavioral Research Program, Division of Cancer Control and Population Sciences, National Cancer Institute, National Institutes of Health, 9609 Medical Center Drive, 3-E-546, Rockville, MD 20850, United States. kaufmana@mail.nih.gov (A.R. Kaufman).

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Conflict of interest

The authors have no conflicts of interest to disclose.

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Contributor's statement

Annette R. Kaufman conceptualized and designed the study, oversaw preliminary data analysis, drafted the initial introduction and discussion sections, reviewed and revised the manuscript, and approved the final manuscript as submitted.

Stephanie Land conceptualized the study and conducted statistical analyses, drafted the initial methods and results sections, reviewed and revised the manuscript, and approved the final manuscript as submitted.

Mark Parascandola, Erik Augustson, and Cathy L. Backinger participated in the conceptualization and design of the study, critically reviewed and revised the manuscript, assisted in the interpretation of the data, and approved the final manuscript as submitted.

Keywords

Adolescent; Tobacco; Smoking; Smokeless; Tobacco; National Longitudinal Study of Adolescent Health

Tobacco use among adolescents and young adults poses a significant public health concern given that nearly 90% of U.S. adult smokers begin smoking by age 18 (Centers for Disease Control and Prevention, 2012). Experimentation with tobacco products is common among adolescents and young adults (U.S. Department of Health Human Services, 2012). In 2013, current tobacco use across all products was highest among adults aged 18–25 compared to all other age groups: 30.6% reported past month use of cigarettes and 5.8% reported smokeless tobacco (ST), defined to include chewing tobacco and snuff, use in the past month (Substance Abuse and Mental Health Services Administration, 2014). Overall, adolescent reports of past 30-day use of ST declined until about 2007 and since then have remained stable (Johnston et al., 2012). Data from the 2011 National Youth Tobacco Survey estimated that 2.2% of middle school students and 7.3% of high school students reported using ST in the last 30 days (Centers for Disease Control and Prevention, 2012). Additionally, ST use prevalence is substantially higher among some adolescent subgroups, such as 12th-grade White males and in certain regions of the country (Substance Abuse and Mental Health Services Administration, 2014; Nelson et al., 2006). While prevalence rates provide information about the use of cigarettes and ST, little research has examined how adolescents and young adults may transition between these products.

Use of multiple tobacco products is also common among adolescents and young adults. Among high school students who report currently using tobacco, more than half of the males and nearly one-half of the females report using more than one product in the last 30 days (2009 Youth Risk Behavior Surveillance System). Numerous studies have documented use of novel, non-cigarette tobacco products by adolescents, particularly in social settings, including use of hookah, little cigars, flavored tobacco products, and non-conventional cigarettes (Agaku et al., 2013; Amrock et al., 2014; King et al., 2014; Parascandola et al., 2008). Research has shown that among tobacco users younger than 26 years of age, the proportion of those using more than one tobacco product increased significantly between 2002 and 2011 (Fix et al., 2014). Dual product use is a concern because evidence suggests that people who use both cigarettes and ST demonstrate higher estimated nicotine exposure levels and find cessation more difficult to achieve than those who use only ST or only smoke (Hatsukami and Severson, 1999; Spangler et al., 2001; Wetter et al., 2002; McClave-Regan and Berkowitz, 2011). However, use of non-cigarette tobacco products among adolescents and young adults, alone or in conjunction with cigarette smoking, is less studied than cigarette smoking alone and presents a complex scientific and public health challenge.

Currently, little is known about patterns of multiple tobacco product use over time, including within person transitions between use of cigarettes and ST from adolescence into young adulthood. A number of studies suggest that ST use is associated with use of other tobacco products, including cigarettes (Boyle et al., 2012). However, substantial gaps remain for characterizing ST use and its relationship to cigarette smoking and there has been a call for

longitudinal research to address this need (Fix et al., 2014; NIH state-of-the-science conference statement on tobacco use, 2006). The main limitation of research to date regarding cigarette and ST use transitions is a dearth of prospective analysis. To the best of our knowledge, five prospective studies have been conducted in the U.S. examining cigarette and ST use (Wetter et al., 2002; O'Connor et al., 2003; Severson et al., 2007; Timberlake et al., 2009; Tomar, 2003). These studies have primarily focused on the *gateway hypothesis*: that ST use may increase the risk of becoming a cigarette smoker. However, the findings from these studies are inconsistent. Although informative, prior research did not address the potential for multiple transitions between ST and cigarettes that may occur over time.

The current study aimed to address these gaps in understanding transitions in use of two products: cigarettes and ST. Using data from the National Longitudinal Study of Adolescent Health (Add Health), in which a cohort was followed from adolescence into young adulthood, the current study will 1) describe prevalence of cigarette smoking, ST use, and the use of both products, 2) analyze patterns of tobacco use over time, including transitions between ST and cigarette product use, and 3) examine how the transitions differ across demographic groups.

Methods

Participants and procedure

Add Health is a study of adolescent health-related behaviors (Udry et al., 2009). The nationally based sampling frame involved the selection of a random sample of 80 high schools (public, private, and parochial) and 54 associated feeder schools throughout the United States and is representative of U.S. schools with respect to region, urbanicity, school size, school type, and ethnic distribution. All students were eligible for selection into the core in-home sample (University of North Carolina and Carolina Population Center). Data were collected in participants' homes. A computer-assisted interview was conducted by a trained interviewer. For sensitive topics, participants responded via audio computer-assisted self interview. A sample of 20,774 male and female adolescents in grades 7 through 12 were selected to participate in the initial in-home survey conducted between April and December 1995 (Wave I). Participants were interviewed at Wave II ($n = 14,738$) approximately 1 year later (April–August 1996), at Wave III ($n = 15,197$) approximately 6 years later (August 2001–April 2002), and at Wave IV ($n = 15,701$) approximately 13 years later (January 2008–February 2009). Wave II surveyed those from the Wave I in-home interviews, but excluded those who were in the 12th grade at Wave I who were not part of the genetic sample, and those who were only in the Wave I disabled sample. (Information regarding the genetic and disabled samples can be found at <http://www.cpc.unc.edu/projects/addhealth/design/wave1>.) Wave III and Wave IV samples consist of Wave I respondents who could be located and re-interviewed.

Measures

Smokeless tobacco use—At each wave participants were asked, “During the past 30 days, on how many days have you used chewing tobacco (such as Red Man, Levi Garrett, or

Beechnut) or snuff (such as Skoal, Skoal Bandits, or Copenhagen)?” Responses were dichotomized to indicate use (yes or no) for each wave.

Cigarette smoking—At each wave participants were asked, “During the past 30 days, on how many days did you smoke cigarettes?” Responses were dichotomized to indicate use (yes or no) for each wave.

Demographic information (Wave I)—Participants’ self-reported sex and age were recorded. Four race categories were constructed based on self-reported data: White, Black, Native American, and Asian (Udry et al., 2003). Region was categorized as West, Midwest, South, and Northeast.

Data analysis

For the purpose of cross-sectional description of the data, participants were classified according to *ever-reported* tobacco use status across all four waves: “**neither**” if the participant never reported cigarette or ST use; “**cigarettes only**” if the participant only ever-reported cigarettes; “**ST only**” if the participant only ever-reported ST; and “**both cigarettes and ST**” if the participant ever-reported using both products (not necessarily reported at the same wave). “Both cigarettes and ST” was further divided into those who reported past 30-day cigarette and ST use at different waves (switching) or those who reported past 30-day cigarette and ST use at the same wave (dual use).

The primary and secondary endpoints, “reported to date” (RTD) and “current use” (CU) were derived from the participants’ reports of past 30-day cigarette and ST use. RTD for a given participant and wave was set to “neither,” “cigarettes only,” “ST ” only, or “both cigarettes and ST.” RTD incorporated all reports to date of each product. The RTD state of “both cigarettes and ST” indicated that both cigarette and ST use had been reported, but not necessarily at the same wave. The secondary analysis endpoint, CU, was defined based only on the status at a given wave: “neither,” “cigarettes only,” “ST only,” or “dual” (both cigarettes and ST reported at the same wave). Transitions from “cigarettes only” to “ST only” (and vice versa) or from multiple to single product use were captured in the CU endpoint.

For both the primary and secondary endpoints, we used Markov modeling to estimate the probabilities of transitioning between tobacco use states. Markov modeling permitted estimation based on data collected at each wave over the full longitudinal study and all observed transitions between states over time (e.g. neither, cigarettes only, ST only, or dual) (Jackson, 2011; Kalbfleisch and Lawless, 1985; Kay, 1986; White et al., 2009). In continuous-time Markov modeling, the probability of transitioning is the outcome variable and the models allow the transitions to have occurred at any point in time from one survey to the next. In these analyses, probabilities were reported on a per-year basis, that is, for a transition with the passage of 1 year at any point in adolescence and young adulthood. The change in 1 year is analogous to a one-unit change of an explanatory variable in a regression analysis. That is, the models estimate the probabilities of transitions over any interval of time during adolescence and young adulthood, not restricted to the specific time points at which surveys were conducted. Model covariates in the primary analysis were gender, age at

assessment, region at assessment, and race. Hazard ratios and 95% confidence intervals indicated the associations with demographic factors and were adjusted for all variables noted. Comparisons of transitions between different pairs of states are presented in the Supplementary Material. Markov model analysis of the secondary endpoint, CU, was performed for the entire sample and the subset most likely to use ST: white males (note: demographic factors were not included in this analysis due to data sparseness for some transitions). Participants who completed only one survey are not included in the Markov modeling. Data management and analysis were performed in SAS v 9.2 (SAS Institute, Cary, NC) and R version 2.15 (R Foundation for Statistical Computing).

Results

Table 1 shows adolescent and young adult ever-reported tobacco use based on demographic variables of interest. Rows A and B show respondents' ever-reported cigarette smoking status (without regard to ST use). Among the total population ($N = 20,774$), 48.8% reported using cigarettes (without regard to ST use) within 30 days during at least one wave. Rows C and D show ever-reported ST use (without regard to cigarette smoking): 12.9% of respondents—21.4% of males and 4.5% of females—reported using ST within 30 days during at least one wave. Rows E-I provide counts of singular and multiple product use; 9.2% reported using both products during at least one wave. Males were more likely than females to report using both cigarettes and ST (15.7% vs. 3.0%). Whites (11.5%) and Native Americans (8.6%) were more likely to report using both products than were Blacks (4.9%) or Asians (4.5%). Use of both product types was highest in the Midwest (11.4%) and lowest in the West (6.9%). Row I provides the subset of respondents who used both products during the same 30-day period. For those who ever-reported using both ST and cigarettes, dual use was more prevalent than switching. That is, while 9.2% of respondents reported use of both products (Row H), 7.2% did so during the same period (Row I). The remaining 2% switched between products over time. Of those participants who ever reported the use of ST and cigarettes, the majority ($1503/1921 = 78\%$) were dual users; only 22% substituted one product for the other over time.

Table 2 shows the current use status (CU) at each wave. Participants reporting current use of only cigarettes became more prevalent over the four waves of the study, increasing from 22.3% at Wave I to 33.5% at Wave IV. Participant reports of current use of only ST were about 3% during the first three waves and dropped to 2.3% at Wave IV. Dual current use status was greatest in Waves I and II at 3.7% and 3.8% respectively, but dropped to 2.2% for both Waves III and IV.

Transitions in tobacco use experience reported to date

Fig. 1 provides hazard ratios (HRs) with 95% confidence intervals for the possible transitions for RTD (neither, cigarettes only, ST only, both cigarettes and ST) based on a model with age, race, gender, and region as explanatory variables. Participants who were female, Asian, Black, or younger were significantly less likely to transition from neither to cigarette over any one-year period (Fig. 1a) than male, White, and older participants, respectively. Compared to participants in the West, participants in other regions were

significantly more likely to transition from using neither product to cigarette use 1 year later. Females, Asians, and younger participants who had reported neither product were also significantly less likely to transition to ST only use 1 year later, compared with male, White, and older participants, respectively (Fig. 1b). Northeastern participants were less likely than westerners to transition to ST only. Female, Black, and younger participants were significantly less likely to transition from neither to using both cigarettes and ST (Fig. 1c).

Among participants who had reported using only cigarettes as of a given time, those who were female, Black, or younger were less likely to subsequently report ST use than participants who were male, White, and older (that is, they were less likely to transition to an RTD status indicating both cigarettes and ST; see Fig. 1d). Among participants who had reported ST only as of a given time, those who were female or younger were less likely to later report cigarette smoking; whereas those who lived in the Midwest or were Native American were more likely than Westerners or Whites to later report cigarette smoking (Fig. 1e).

From the Markov model, *transition probabilities* (that is, the probability of transitioning among tobacco products within a period of 1 year) may be estimated for any combination of demographic factors included. As an example, the transition probability for 13-year old White males in the western region from ST only to also smoking cigarettes 1 year later is 7.8% and their transition probability from using only cigarettes to adopting ST use 1 year later is 3.4%. The transition rate from ST only to both products is significantly greater than that for cigarette only to both products, with a ratio of 2.4 (95% confidence interval [CI] 1.5–3.7). (See Supplementary Material).

Transitions in current tobacco product use

Table 3 provides the estimated transition probabilities for the four states of CU (neither, cigarettes only, ST only, dual). Among participants reporting cigarettes only at a given time point, the probability of transitioning to ST or dual use over 1 year is 1.3% (sum of .38% and .92%). The analogous probability among those who were using neither product is 1.2% (sum of .94 and .25). Among participants who report ST only, the probability of transitioning to cigarettes or dual use was 4.6% (sum of 1.6% and 3%). Among those who were using neither tobacco product, the probability of transitioning to cigarettes or dual use was 5.6% (sum of 5.4% and .25%). Among participants reporting dual use, the transition probability to neither product was 13%, to cigarettes only was 5.5%, to ST only was <1%, and continuance of both products was 81%.

Table 3 also provides the estimated transition probabilities for the four states of CU for White male participants. The probability of transitioning to ST (ST only or dual) among White males who report cigarettes only and neither tobacco product was 3.3% (sum of .56% and 2.7%) and 2.4% (sum of 1.9% and .54%) respectively. Among White males who report ST only and neither tobacco product, the probability of transitioning to cigarettes (cigarettes only or dual) was 6.5% and 7.8% respectively. Among White male participants reporting dual use, the transition probability to neither product 1 year later was 15% and continuance of both products 1 year later was 80%.

Discussion

This study represents an analysis of prospective data on cigarettes and ST product use in a nationally representative cohort followed from adolescence into young adulthood. Little data were previously available on within-person transitions between cigarettes, ST, and dual use over time for adolescents and young adults and this study provides new insights into these transitions. Among the cohort (N = 20,774), 48.8% reported using cigarettes and 12.9% reported using ST in at least one wave. The prevalence of ever-reported dual use (using both products within the same 30 days) was 7.2%. Importantly, this study shows that of the participants who ever reported use of both cigarettes and ST, the majority (78%) were dual users (that is, they used cigarettes and ST at the same time point). Dual users also exhibited a high probability of continuing dual use over time (e.g. an estimated 81% will still be dual users 1 year later). Our findings suggest that dual product use is a persistent behavior rather than a form of experimentation.

Consistent with other studies, cigarette smoking reported in the past 30 days increased over time as the sample aged from adolescence into young adulthood, and the prevalence of ST use and multiple product use was higher among participants who were White and Midwest residents compared with other groups. Also consistent with previous literature (Nelson et al., 2006; Bombard et al., 2008), we found that males were more than four times as likely as females to report ever using ST (21% versus 5%). Furthermore, those particularly susceptible to transitioning between cigarettes and ST included those who were older, male, and White. The probability of transitioning from ST use to use of cigarettes at a later wave was greater than that for transitioning from cigarettes to ST (see Supplementary Material). However, it should be noted that because cigarette smoking is substantially more prevalent than ST use, it is expected that any tobacco use behavior may be more likely to include cigarette smoking than ST use. Previous research examining transition patterns in cigarette smoking among adolescents and young adults and using a similar methodology found light and intermittent smoking to be relatively unstable over time compared with non-smoking or heavy smoking status; in this way, the patterns of dual product use observed in our study resemble heavy tobacco use, light, or experimental use (White et al., 2009).

Although this study focused exclusively on cigarette and ST transitions, it is important to note that other tobacco products need to be considered when addressing transitions. The tobacco product market has undergone substantial changes in recent years. Manufacturers have introduced and marketed a range of tobacco products that differ from conventional cigarettes. ST products are being marketed with attractive flavorings (such as mint or fruit flavors) and new delivery methods (such as lozenges or small pouches) (Feder, 2007; Villanti et al., 2013). Recent reports also show that use of e-cigarettes has risen rapidly among adolescents (Agaku et al., 2014), including among those who have not previously smoked cigarettes, and is associated with future intentions to smoke cigarettes (Bunnell et al., 2014; Primack et al., 2015). Novel tobacco products may also be marketed alongside cigarettes or as complementary products for use in situations where smoking is prohibited (Brock et al., 2014), which may lead to increased dual or multiple product use (O'Hegarty et al., 2007; Wang et al., 2014). To evaluate the long term public health implications of such trends, it is important to continue to monitor and understand complex tobacco use behaviors

(Henningfield et al., 2002; O'Connor et al., 2009). The findings in this study provide further support to calls for improved monitoring of poly-tobacco use across the life course (Rath et al., 2012) and better transition definitions (Klesges et al., 2011).

Finally, understanding transitions to other tobacco products and multiple use is needed to inform tobacco control program planning and for regulation of tobacco products. Studies suggest that users of multiple tobacco products may have different perceptions of tobacco product risks and respond differently to health risk messages (Agaku et al., 2013; Primack et al., 2008). Moreover, the population health standard of the Family Smoking Prevention and Tobacco Control Act (TCA) (Food and Drug Administration, 2009) directs the Food and Drug Administration to consider the impact of regulatory actions on users and nonusers of tobacco products, taking into account the increased or decreased likelihood that existing users will stop using products and the increased or decreased likelihood that those who do not use tobacco products will start. Thus, as the tobacco product market continues to change with the introduction of novel products and changes in prevalence, understanding tobacco use behavior and related health effects will require greater attention to patterns of multiple product use.

There are several limitations to this study. The study relied on self reports of tobacco product use without biochemical validation (Kandel et al., 2006). Given the sampling frame, the sample size of potentially important minority groups (e.g., Native Americans) in this study is small and estimates of transitions in use are unstable. The set of demographic variables analyzed were selected a priori as the parsimonious set of greatest interest; these did not include ethnicity or socioeconomic status. Our control variables were from baseline and indicators such as socioeconomic status may not persist over the life course. Prior research has indicated that race and socioeconomic status are intimately intertwined (Fiscella and Williams, 2004; Williams, 1996). Another noted limitation is that, given the complexity of the analyses across various waves of data, the results presented were not weighted to provide nationally representative estimates. The effect of attrition on estimates of cigarette and ST use is unclear. Baseline rates of cigarette and ST use were nearly identical between participants who were surveyed at only one wave versus those surveyed more than once. Participants who were surveyed at multiple waves were more likely to be White, from the Midwest, and female, than participants surveyed only once. These selection factors have opposing associations with tobacco use prevalence, mitigating their effects on estimates. An additional limitation is that the data used in this study were drawn from waves of a longitudinal study from 1995 to 2009. Since that time, changes have occurred in both tobacco control efforts and tobacco marketing and product availability. The survey did not collect data on some other forms of tobacco use, such as hookah, that are becoming prevalent among adolescents and may be used with other tobacco products. The ST question in the Add Health survey may not represent the full range of current ST products available on the market. Consequently, the prevalence estimates provided by this dataset may not reflect current rates of use. These results, however, provide a basis for needed further study from which the impact of increased marketing and new products can be assessed.

Conclusion

The findings of this study indicate a substantial amount of transitioning between ST use and cigarette smoking among adolescents and young adults, but dual use of cigarettes and ST is both prevalent and persistent. When addressing tobacco use among adolescents and young adults through research and interventions, multiple forms of tobacco should be considered. Further research is needed to provide a better understanding of tobacco use susceptibility, experimentation, and initiation in the context of transitions between single products, as well as dual and multiple tobacco product use. Continued monitoring of adolescent and young adult use of various forms of tobacco and the transitions of product use is needed.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Abbreviations

CU	current use
RTD	reported to date
ST	smokeless tobacco

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.ypmed.2015.08.026>.

Fig. 1. Hazard ratios (HRs) with 95% confidence intervals for the transitions in reported to date (RTD) tobacco use, adjusted for age, race, gender, and region. Graphs are shown only for possible transitions. Data were collected in the United States in 1995–2009.

Table 1

Ever-reported past 30-day tobacco use (Waves I–IV), according to Wave I participant sociodemographic characteristics, N (%).^{a,b}

(row)	Total	Male	Female	White	Black	Native American	Asian	US Region: West	US Region: Midwest	US Region: South	US Region: North East
Ever-reported cigarette use											
No (A)	10646 (51.2)	4941 (48.1)	5705 (54.3)	6100 (45.2)	3095 (64.2)	205 (50.2)	937 (60.9)	2766 (56.3)	2086 (43.8)	4120 (54.0)	1424 (48.2)
Yes (B)	10128 (48.8)	5326 (51.9)	4802 (45.7)	7381 (54.8)	1723 (35.8)	203 (49.8)	602 (39.1)	2151 (43.7)	2682 (56.3)	3513 (46.0)	1533 (51.8)
Ever-reported ST ^c use											
No (C)	18101 (87.1)	8069 (78.6)	10032 (95.5)	11421 (84.7)	4400 (91.3)	361 (88.5)	1436 (93.3)	4384 (89.2)	4080 (85.6)	6588 (86.3)	2603 (88.0)
Yes (D)	2673 (12.9)	2198 (21.4)	475 (4.5)	2060 (15.3)	418 (8.7)	47 (11.5)	103 (6.7)	533 (10.8)	688 (14.4)	1045 (13.7)	354 (12.0)
Ever-reported cigarette or ST ^c use											
No (E)	9894 (47.6)	4350 (42.4)	544 (52.8)	5593 (41.5)	2912 (60.4)	193 (47.3)	903 (58.7)	2574 (52.3)	1943 (40.8)	3802 (49.8)	1341 (45.4)
Yes											
Cigarettes only (F)	8207 (39.5)	3719 (36.2)	4488 (42.7)	5828 (43.2)	1488 (30.9)	168 (41.2)	533 (34.6)	1810 (36.8)	2137 (44.8)	2786 (36.5)	1262 (42.7)
ST ^c only (G)	752 (3.6)	591 (5.8)	161 (1.5)	507 (3.8)	183 (3.8)	12 (2.9)	34 (2.2)	192 (3.9)	143 (3.0)	318 (4.2)	83 (2.8)
Both cigarettes and ST ^{c,d} (H)	1921 (9.2)	1607 (15.7)	314 (3.0)	1553 (11.5)	235 (4.9)	35 (8.6)	69 (4.5)	341 (6.9)	545 (11.4)	727 (9.5)	271 (9.2)
Both cigarettes and ST, ^c Dual ^e (I)	1503 (7.2)	1267 (12.3)	236 (2.2)	1275 (9.5)	138 (2.9)	24 (5.9)	46 (3.0)	234 (4.8)	435 (9.1)	570 (7.5)	233 (7.9)
Total	20774	10267	10507	13481	4818	408	1539	4917	4768	7633	2957

Data were collected in the United States in 1995–2009.

^aRace excludes 528 (2.4%) with missing Wave I race information. Race was constructed by the Add Health research team according to 22 coding steps based on participant and parent reported race at Wave I.

^bRegion excludes 499 (2.4%) with missing Wave I region information.

^cST: smokeless tobacco.

^dUse of both smokeless tobacco and cigarettes, not necessarily during the same 30-day period.

^eUse of both smokeless tobacco and cigarettes within the same 30-day period.

Table 2

30-day current tobacco use (CU) reported at each wave.

	Interview wave (I–IV)							
	Wave I (1995)		Wave II (1996)		Wave III (2001–2002)		Wave IV (2008–2009)	
	N	%	N	%	N	%	N	%
No tobacco use reported in past 30 days	14366	71.1	9394	64.8	9776	65.2	9654	62.0
Only cigarette use reported in past 30 days	4506	22.3	4069	28.1	4417	29.5	5211	33.5
Only smokeless use reported in past 30 days	583	2.9	479	3.3	468	3.1	352	2.3
Dual use reported in past 30 days	756	3.7	546	3.8	334	2.2	345	2.2
Total responses	20211		14488		14995		15562	
Total surveyed	20745		14738		15197		15701	
Percent responded		97.4		98.3		98.7		99.1

Data were collected in the United States in 1995–2009.

Table 3

Estimated probability of transition between current tobacco product use states over a 1-year period.^a

Percentage (95% confidence interval)	Neither	Cigarettes only	Smokeless only	Both cigarettes and Smokeless
Neither	93 (93, 94)	5.4 (5.2, 5.6)	0.94 (0.84, 1.0)	0.25 (0.21, 0.30)
Cigarettes only	8.6 (8.3, 9.0)	90 (90, 90)	0.38 (0.30, 0.48)	0.92 (0.82, 1.0)
Smokeless only	20 (18, 22)	1.6 (1.4, 1.9)	75 (73, 77)	3.0 (2.4, 3.9)
Both cigarettes and Smokeless	13 (11, 14)	5.5 (5.0, 6.1)	0.79 (0.66, 0.95)	81 (79, 83)
<i>Transitions in current use (CU) status among White males</i>				
Neither	90 (90, 91)	7.3 (6.8, 7.7)	1.9 (1.7, 2.2)	0.54 (0.42, 0.73)
Cigarettes only	7.6 (7.0, 8.3)	89 (88, 90)	0.56 (0.4, 0.81)	2.7 (2.4, 3.1)
Smokeless only	14 (12, 16)	1.3 (1.1, 1.6)	79 (77, 81)	5.2 (4.2, 6.3)
Both cigarettes and smokeless	15 (13, 18)	4.0 (3.4, 4.7)	0.73 (0.59, 0.92)	80 (77, 82)

Data were collected in the United States in 1995–2009.

^aProbabilities of transition from the state indicated in the row heading to the state indicated in the column heading.