Use of tobacco products among rural older adults: Prevalence of ever use and cumulative lifetime use

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Abstract:
Tobacco use is a well-documented contributor to morbidity and mortality in the US and worldwide. Information on the comprehensive use of tobacco products is lacking, particularly smokeless tobacco in its various forms. Data from 635 older (>_60 years) African American, American Indian and White adults in rural North Carolina were analyzed to assess current and lifetime use of cigarettes, cigars, pipe, snuff and chewing tobacco. Participants were classified as being current, former or never users of each product, Lifetime use of each product was determined by asking about typical intensity of use per day and length of time the product has been used. About 70% of participants were current or former users of any tobacco product, and about one-third of participants currently used at least one product. Variations in use were observed by ethnicity and sex, particularly for cigarettes, snuff and chewing tobacco. Variations were also seen according to other demographic and health characteristics. These data add to a limited body of literature on lifetime use of smoked and smokeless tobacco products, and are useful in identifying the impact of these products on morbidity and mortality, particularly for vulnerable populations.

Keywords:
African American, American Indian, Cigarettes, Smokeless tobacco, Cigars, Pipe, Older adults

Article:

1. INTRODUCTION

Tobacco use is one of the leading preventable causes of death and disability in the United States and worldwide, and contributes to the health disparities experienced by some racial and ethnic minority groups (Albandar, Streckfus, Adesanya, & Winn, 2000; Beck, Cusmano, Green-Helms, Koch, & Offenbacher,1997; Centers for Disease Control and Prevention, 2003, 2005a,b; Jette, Feldman, & Tennstedt,1993; U.S. Department of Health and Human Services, 2004; World Health Organization, 2008). An accurate assessment of the impact of tobacco use on the health of populations requires a measurement technique that most closely reflects the duration and intensity of use of tobacco products. The use of all tobacco products, including cigarettes, cigars, pipes and the various forms of smokeless tobacco, must also be considered. Both ever use and cumulative lifetime use of these products should be examined. Tobacco use status is often determined from self-report and classified as current or former use (collectively referred to as "ever" use) or never use. Intensity of use of tobacco products must be measured. For cigarettes, the typical strategy that is used is to calculate cumulative exposure is "pack years," which is calculated by multiplying the number of packs of cigarettes smoked per day by the number of years the person has smoked. However, to our knowledge, no documented approaches for determining cumulative lifetime use of other tobacco products exist. Measuring cumulative lifetime use of these products would be beneficial to provide a more accurate assessment of risk as opposed to ever use, and to more fully understanding the health risks associated with their use. Cigars and pipes are not commonly used in the general population. Smokeless tobacco is commonly used only in some subsections of the population, including

adolescents, persons in the southeastern US and in rural communities and some ethnic minority groups (Substance Abuse and Mental Health Services Administration, 2006; Centers for Disease Control and Prevention, 2005a,b; Bell, Spangler, & Quandt, 2000). Determination of long-term use of these latter products is important in understanding their impact on health outcomes (Beck et al., 1997; U.S. Department of Health and Human Services, 2004).

In this paper, we examine ever and cumulative lifetime use of commonly available tobacco products in an ethnically diverse rural older adult population. This population has high rates of tobacco use and presents the opportunity to examine long-term use of tobacco products and ethnic differences in ever and cumulative lifetime use of these products. We present an approach in the assessment of lifetime use of cigars, pipes and smokeless tobacco products not previously available in the literature. We also determine the demographic and health correlates of ever and cumulative lifetime use of these products. Our intention is that these approaches may be used in future considerations of the impact of all tobacco products on morbidity and mortality.

2. METHODS

2.1. Sample design
Data were collected in a cross-sectional survey among older rural adults in two south center North Carolina counties. Eligible participants included community-dwelling English-speaking older adults aged 60 years and older. Participants were located using a random dwelling selection and screening procedure based on a multi-stage cluster sampling design in which the primary sampling units (clusters) were stratified and selected with probability proportionate to their sizes (Frankel, 1983). This procedure was designed and implemented by the investigators in consultation with the University of Illinois Survey Research Laboratory,

Within 80 randomly selected, mapped clusters, 5545, dwelling units were identified. Thirty-nine of these dwelling units were not screened, 4647 were screened but did not include an eligible participant, and 859 included an eligible participant. The screening rate was 99.3%, Interviewers attempted to recruit participants who met the inclusion criteria in each randomly selected dwelling in a cluster. Once an eligible resident was identified, the interviewer asked to speak with that individual. If the individual was not at home, the interviewer made an appointment to return. The interviewer made at least three additional attempts to contact the selected individual at times which other residents indicated the individual would normally be at home. All randomly selected dwellings were maintained in the sample until their dispositions were finalized.

The eligible resident in 635 of the 859 eligible dwelling units completed the interview, and 224 refused to complete the interview, for a response rate of 73.9%. The University of Illinois Survey Research Laboratory provided weights for each participant based on the size of the cluster from which he/she was selected, and his/her probability of selection within each dwelling unit.

2.2. Data collection
Data for this analysis were collected between January 2006 and March 2008 by face-to-face survey administered by local interviewers. All interviewers completed one day of didactic training performed by the research team, and each recorded practice interviews that were reviewed and approved. Ten percent of each interviewer's interviews were verified by telephone. Personal interviews were completed in participant homes or in another location of the participant's choosing, such as a senior center. Interviews took from 1.5 to 2.5 h to complete. Participants were given an incentive valued at $10.00 at the completion of the interview. Data collection procedures were reviewed by the Wake Forest University School of Medicine Institutional Review Board. Informed consent was obtained from all study participants.

Relevant to this analysis, the survey instrument included the following: demographics (age, ethnicity, sex, marital status, formal education), dental and health insurance, financial resources, self-rated health, tobacco use and the physical component score (PCS) of the Medical Outcome Survey (MOS) Physical Function scales

(Stewart & Kamberg,1992). The survey instrument was pre-tested in a sample of older adults of the same age group as the study participants and, based on feedback provided by these participants, the instrument was determined to be acceptable for length and language. In addition to survey data, height was measured using a standard stadiometer and weight was measured using standard scales. For those unable to have height and/or weight measured (n=61 of 620 reported weights, 9.8%), self-report was used. These measures were combined to calculate body mass index (BMI).

2.3. Variable descriptions

The primary variables for this analysis were tobacco use, which was assessed to reflect both ever and cumulative lifetime use, as well as the use of the various tobacco products that are common in the study communities. Cigarette use was determined first by asking participants if they had smoked at least 100 cigarettes in their lifetime. Those responding "yes" (ever users) were then asked if they currently smoked. Current smokers were those who answered yes to both questions, former smokers were those who answered yes to the first question and no to the second question, and never smokers were those who answered no to the first question. To assess cumulative lifetime use, ever users were asked at what age they began smoking, and former smokers were asked at what age they quit smoking. Number of years smoked was calculated as current age minus age participant began smoking for current smokers, and age which participant quit smoking minus age participant began smoking for former smokers. Both groups were asked how many packs of cigarettes on average they smoked per day. Cumulative lifetime use was calculated as pack years, defined using a standard definition as the number of years smoked times the average number of packs smoked per day (National Cancer Institute, 2008).

A similar strategy was used for cigar and pipe use. Ever pipe or cigar users were defined as those who had smoked a pipe at least 20 times or had smoked 20 cigars in their life. The definition of ever use of cigar and pipe as 20 times or more has been used previously in the National Health and Nutrition Examination Survey (NHANES). Cigar years (defined as total number of years that participant smoked cigars times the average number of cigars smoked per day) and pipe years (defined as total number of years participant smoked pipe times the average number of pipesful smoked per day) were calculated for each participant.

For smokeless tobacco use, information was collected on the use of snuff and chewing tobacco. Ever use was defined as having used these products at least 20 times in their life. Cumulative lifetime use for snuff ("pinch years") was determined by assessing the average number of pinches, dips or rubs used per day times the number of years used. For chewing tobacco, the number of pouches or plugs reported was converted to ounces of tobacco based on information obtained in the community. "Chew years" was then calculated as ounces per day times the number of years used.

Correlates included in this analysis include the following: demographics — age (continuous); ethnicity (African American, American Indian or White); sex; marital status (yes or no); socioeconomic status — health insurance (yes or no), poverty status (below or above the poverty level according to current federal poverty level guidelines appropriate for the respondent's household), education (sixth grade or less, seventh and eighth grade, less than high school, high school, more than high school), dental insurance (yes or no), health — self- rated health (excellent, very good, good, fair, poor), physical functioning from the PCS (continuous, higher scores indicated better physical functioning) and BMI. BMI was calculated as weight in kilograms divided by height in meters squared. Participants were classified as obese based on having a BMI of ≥ 30.

2.4. Statistical analysis

All analyses were performed to account for the stratified, multistage cluster sampling design of our study. Data were summarized using weighted means and standard errors for continuous variables and weighted N and percents for categorical variables. This process often yielded an N represented by a fraction. Bivariate associations

Table 1
Descriptive characteristics of the weighted study sample.

Variable	Total	Current and former tobacco users	Never users
Total N	635	456.3	178.8
Age [mean $\pm$ SE]	71.5 $\pm$ 0.4	70.5 $\pm$ 0.4	74.1 $\pm$ 0.7
Ethnicity [N (%)]			
African American	135.9 (21.4)	98.0 (21.5)	37.9 (21.2)
American Indian	195.3 (30.7)	145.4 (31.9)	49.9 (27.9)
White	303.8 (47.8)	212.9 (46.7)	91.0 (50.9)
Sex [N (%) female]	343.8 (54.1)	203.7 (44.6)	140.2 (78.4)
Marital status [N (%) married]	295.9 (46.6)	210.1 (46.0)	85.8 (48.0)
Health insurance [N (%)]	593.5 (93.5)	418.3 (91.7)	175.3 (98.1)
Poverty status [N (%)]			
Below poverty level	204.0 (32.1)	151.3 (33.2)	52.7 (29.5)
Above poverty level	431.0 (67.9)	304.9 (66.8)	126.1 (70.5)
Education [N (%)]			
Grade 6 and below	108.9 (17.1)	76.7 (16.8)	32.1 (18.0)
Grades 7 and 8	100.8 (15.9)	80.2 (17.6)	20.7 (11.6)
Less than high school	144.0 (22.7)	113.9 (25.0)	30.1 (16.8)
High school	155.8 (24.5)	107.5 (23.6)	48.3 (27.0)
More than high school	125.5 (19.8)	78.0 (17.1)	47.5 (26.6)
Dental insurance [N (%)]	64.1 (10.1)	41.7 (9.1)	22.5 (12.6)
Self-rated health [N (%)]			
Excellent	38.0 (6.0)	24.6 (5.4)	13.4 (7.5)
Very good	132.4 (20.9)	83.8 (18.4)	48.6 (27.2)
Good	193.7 (30.6)	142.7 (31.4)	51.0 (28.6)
Fair	157.9 (24.9)	112.4 (24.7)	45.6 (25.5)
Poor	111.2 (17.6)	91.4 (20.1)	19.8 (11.1)
Physical functioning score [mean $\pm$ SE]	49.9 $\pm$ 1.8	49.1 $\pm$ 2.0	51.9 $\pm$ 3.6
Body mass index [mean $\pm$ SE]	29.4 $\pm$ 0.4	29.2 $\pm$ 0.4	29.7 $\pm$ 0.7
Obese [N (%)]	232.9 (37.9)	168.2 (38.2)	64.7 (37.2)

between tobacco use and demographic and health characteristics were tested using regression techniques: logistic regression was used to determine associations with dichotomous tobacco use (i.e., ever vs. never), and linear regression was used to determine associations with cumulative lifetime tobacco use among current/former users (e.g., pack years). Lifetime use of each product was log transformed for analyses. Given the large number of comparisons (121) we made in our analyses, the traditional approaches to controlling the familywise error rate such as Bonferroni corrections are not powerful in testing the multiple hypotheses simultaneously. Therefore, we chose to use the false discovery rate (FDR) as an alternative way to quantify errors in this situation (Benjamini & Hochberg,1995). The FDR reflects the expected proportion of erroneously rejected hypotheses among all rejected hypotheses. Significance of a particular hypothesis test was examined using multiplicity-adjusted p-values to control the FDR to be no greater than 0.05. Thus, among the 30 rejected null hypotheses in Tables 3a and 3b, we expect that only 1.5 of these are false discoveries. All analyses were completed using SAS version 9.1 (Cary, NC).

3. RESULTS

The sample included roughly equal numbers of men and women and slightly more than half were ethnic minority (African American 21.4%, American Indian, 30.7%) (Table 1). The average age of the sample was 71.5 (standard error, SE=2,4) years. About one-third of the sample lived below the poverty level and over half had less than a high school education. Over 40% reported their health as fair or poor, and about the same percentage were classified as obese.

Over 70% of participants had used some form of tobacco in their lifetime (current and former users) (Table 1). Ever tobacco users were younger, were slightly more likely to be a member of an ethnic minority group, to be male, to not have health insurance, to be living in

Table 2
Tobacco use, overall and by ethnicity and sex (weighted number and percentage).

	African American	American Indian	White	Male	Female	Total
Sample *N*	212	226	197	274	361	635
Weighted *N*	135.9	195.3	303.8	291.2	343.8	635
Cigarettes						
Current	20.8 (15.3)	41.1 (21.1)	59.6 (19.6)	80.4 (27.6)	41.1 (12.0)	121.5 (19.1)
Former	44.9 (33.0)	60.7 (31.1)	134.4 (44.2)	149.6 (51.4)	90.4 (26.3)	240.0 (37.8)
Never	70.2 (51.7)	93.4 (47.8)	109.9 (36.2)	61.2 (21.0)	212.3 (61.7)	273.6 (43.1)
Pack years [mean (SE)][a]	22.7 (2.3)	26.6 (2.2)	43.2 (3.5)	38.9 (3.0)	26.3 (3.4)	34.5 (2.4)
Cigars						
Current	1.2 (0.9)	3.3 (1.7)	6.0 (2.0)	10.5 (3.7)	0.0 (0.0)	10.5 (1.7)
Former	9.9 (7.3)	18.7 (9.6)	33.9 (11.3)	57.4 (20.0)	5.1 (1.5)	62.5 (9.9)
Never	124.8 (91.8)	172.8 (88.7)	260.4 (86.7)	219.3 (76.4)	338.7 (98.5)	558.0 (88.4)
Cigar years [mean (SE)][a]	21.2 (4.6)	28.4 (6.0)	43.7 (27.0)	36.1 (16.6)	31.8 (3.4)	35.7 (15.1)
Pipe						
Current	0.7 (0.5)	2.6 (1.3)	4.1 (1.3)	7.4 (2.5)	0.0 (0.0)	7.4 (1.2)
Former	5.9 (4.3)	15.8 (8.1)	34.6 (11.4)	52.1 (17.9)	4.2 (1.2)	56.2 (8.9)
Never	129.3 (95.2)	176.9 (90.6)	265.2 (87.3)	231.8 (79.6)	339.7 (98.8)	571.4 (90.0)
Pipe years [mean (SE)][a]	22.7 (11.1)	26.2 (7.0)	35.9 (13.1)	31.8 (7.8)	2.0 (—)	31.2 (7.6)
Snuff						
Current	9.1 (6.7)	22.8 (11.7)	11.3 (3.7)	9.0 (3.1)	34.1 (9.9)	43.1 (6.8)
Former	22.6 (16.7)	37.0 (19.0)	18.5 (6.1)	18.2 (6.3)	59.9 (17.4)	78.1 (12.3)
Never	104.2 (76.7)	135.4 (69.4)	274.1 (90.2)	264.0 (90.6)	249.8 (72.7)	513.8 (80.9)
Pinch years [mean (SE)][a]	70.4 (8.8)	88.5 (8.3)	119.8 (26.6)	70.0 (15.5)	95.1 (9.8)	89.4 (8.4)
Chewing tobacco						
Current	15.8 (11.6)	44.0 (22.5)	14.9 (4.9)	36.1 (12.4)	38.5 (11.2)	74.6 (11.8)
Former	12.3 (9.1)	38.7 (19.8)	31.8 (10.5)	48.1 (16.5)	34.7 (10.1)	82.8 (13.0)
Never	107.8 (79.3)	112.6 (57.7)	257.1 (84.6)	206.9 (71.1)	270.6 (78.7)	477.6 (75.2)
Pouch years [mean (SE)][a]	31.9 (3.4)	37.5 (6.5)	24.8 (6.9)	28.9 (4.3)	37.7 (6.8)	33.1 (4.2)
Current use of any tobacco product						
0	97.3 (71.6)	110.3 (56.5)	218.5 (71.9)	177.7 (61.0)	248.4 (72.2)	426.0 (67.1)
1	30.5 (22.4)	63.1 (32.3)	77.7 (25.6)	91.2 (31.3)	80.1 (23.3)	171.2 (27.0)
2	7.6 (5.6)	16.6 (8.5)	5.5 (1.8)	17.1 (5.9)	12.5 (3.6)	29.6 (4.7)
3	0.7 (0.5)	4.5 (2.3)	1.8 (0.6)	4.1 (1.4)	2.9 (0.8)	7.0 (1.1)
4	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
5	0.0 (0.0)	0.8 (0.4)	0.3 (0.1)	1.1 (0.4)	0.0 (0.0)	1.1 (0.2)

[a] Among current and former users.

Table 3a
Bivariate associations[a] between ever tobacco use and demographic and health characteristics.

	Cigarettes	Cigars	Pipe	Snuff	Chewing tobacco	Any product
Age (1 yr increment)	0.95 (0.93–0.97)	0.96 (0.93–0.99)	NS	NS	0.97 (0.95–0.99)	0.95 (0.93–0.97)
Ethnicity		NS	NS			NS
AA vs. White	0.53 (0.35–0.80)			2.80 (1.62–4.86)	NS	
AI vs. White	0.62 (0.43–/0.89)			4.07 (2.51–6.62)	4.04 (2.65–6.16)	
Sex (female vs. male)	0.17 (0.12–0.24)	0.05 (0.02–0.12)	0.05 (0.02–0.13)	3.65 (2.30–5.78)	NS	0.22 (0.15–0.33)
Marital status (no vs. yes)	NS	0.49 (.30–.81)	NS	1.79 (1.19–2.71)	NS	NS
Insurance status (no vs. yes)	NS	2.73 (1.28–5.80)	2.84 (1.30–6.21)	NS	NS	4.58 (1.51–13.91)
Poverty status (yes vs. no)	NS	NS	NS	0.28 (0.19–0.43)	NS	NS
Education	NS	NS	NS			
<6th grade vs. more than high school				10.99 (4.13–29.26)	3.28 (1.68–6.41)	NS
7th/8th grade vs. more than high school				10.17 (3.78–27.33)	5.32 (2.74–10.33)	2.36 (1.29–4.32)
Some high vs. more than high school				6.77 2.55–17.96)	2.31 (1.20–4.44)	2.31 (1.35–3.97)
High school vs. more than high school				3.57 (1.31–9.78)	1.67 (0.86–3.26)	NS
Dental insurance (no vs. yes)	NS	0.36 (0.19–0.68)	NS	NS	NS	NS
Self-rated health Excellent/very good vs. poor	NS	NS	NS	NS	0.49 (0.28–0.85)	0.38 (0.21–0.67)
PCS score (1 point increment)	NS	NS	NS	0.99 (0.98–0.99)	NS	NS
Obese (no vs. yes)	NS	NS	NS	NS	NS	NS

[a] Logistic regression (current/former vs. never) and odds ratios and 95% confidence intervals are reported for significant outcomes.

health as fair or poor. BMI was slightly higher and physical functioning scores were slightly lower for tobacco users.

Nineteen percent of the sample currently used cigarettes, with rates being slightly lower for African Americans compared to Whites and American Indians, and much lower for women compared to men (Table 2). Pack years of cigarette use were 34.5 (SE = 2,4) overall and ranged from 43.2 (SE=3,5) for Whites to 22.7 (SE=2,3) for African Americans. Pack years were almost 50% higher for men compared to women (38.9 vs. 26.3, respectively). Cigar and pipe use was fairly uncommon overall (current use, 1,7% and 1.2% respectively) and across ethnic and sex groups. The mean cigar years and pipe years were 35.7 (SE =15,1) and 31.2 (SE = 7,6), respectively.

Use of smokeless tobacco products varied considerably across ethnicity and sex groups. Use of both snuff and chewing tobacco was highest among American Indians, and snuff use was three times higher for women compared to men (9.9% vs. 3.1%, respectively). Average pinch years for snuff was 89.4 (SE = 8,4) and chew years for chewing tobacco was 33.1 (SE = 4,2), Overall current use of smokeless products was 6.8% and 11.8%, respectively.

About one-third of participants used at least one tobacco product, and use of more than one product was highest among American Indians and similar among men and women. Use of three or more tobacco products was rare.

Ever use of any tobacco product was significantly associated with being younger, being male, lacking health insurance, having less education levels and poorer self-rated health (Tables 3a and 3b). Ever use of cigarettes was associated with being younger, being White and male sex. Ever use of cigars was associated with being younger, being male, being married, not having health insurance, and having dental insurance. Ever use of pipes was associated with male sex and not having health insurance. Ever use of snuff was associated with African American or American Indian ethnicity, female sex, not being married, not being in poverty, lower education level, and lower PCS scores. Ever use of chewing tobacco was associated with younger age, American Indian ethnicity, lower education level and poorer self-rated health, associated with White ethnicity, male sex and having insurance. Cigar years was associated with higher levels of self-rated. Pipe years was associated with not being obese. Use of both smokeless tobacco products was not associated with any of these characteristics.

Table 3b
Bivariate associations[a] between cumulative lifetime tobacco use and demographic and health characteristics.

	Cigarettes	Cigars	Pipe	Snuff	Chewing tobacco
Age (1 yr increment)	NS	NS	NS	NS	NS
Ethnicity		NS	NS	NS	NS
AA vs. White	− 0.701 (0.0004)				
AI vs. White	− 0.618 (0.0003)				
Sex (female vs. male)	− 0.581 (0.0002)	NS	NS	NS	NS
Marital status (no vs. yes)	NS	NS	NS	NS	NS
Insurance status (no vs. yes)	− 0.820 (0.0072)	NS	NS	NS	NS
Poverty status (yes vs. no)	NS	NS	NS	NS	NS
Education	NS	NS	NS	NS	NS
<6th grade vs. more than high school					
7th/8th grade vs. more than high school					
Some high vs. more than high school					
High school vs. more than high school					
Dental insurance (no vs. yes)	NS	NS	NS	NS	NS
Self-rated health	NS	1.447	NS	NS	NS
Excellent/very good vs. poor		(0.0223)			
PCS score (1 point increment)	NS	NS	NS	NS	NS
Obese (no vs. yes)	NS	NS	1.565 (0.0117)	NS	NS

a Linear regression of cumulative lifetime use and beta coefficients and p-values are reported for significant outcome.

4. DISCUSSION

The goal of this analysis was to examine comprehensively the prevalence and correlates of the use of various tobacco products in an ethnically diverse sample of older adults in rural North Carolina. Despite a wealth of literature on relationships with tobacco use and health outcomes, this analysis offers a unique approach in that we examined both ever, and cumulative lifetime use, for all commonly used tobacco products. We also were able to examine these associations in a population known for having high rates of tobacco use, particularly smokeless tobacco products. This population is of particular interest because of their rich economic and cultural ties to tobacco, and because previous data have shown that rural residence, particularly in the Southern US, is associated with higher rates of tobacco use (Doescher, Jackson, Jerant, & Gary Hart, 2006; Howard- Pitney & Winkleby, 2002).

Our analyses generated a number of significant results. First, a large number (71.8%) of these older adults had used some form of tobacco in their lifetime. Of particular note is the very high rate of smokeless tobacco use, especially among American Indians, a finding we have documented previously (Spangler, Bell, Dignan, & Michielutte,1997; Spangler et al., 2001; Spangler, Case, Bell, & Quandt, 2003). A recent report of data from the National Survey on Drug Use and Health showed that American Indians ages 18 and older had the highest rates of use of any tobacco products in the past 30 days compared to all other major race/ethnic groups in the US (Carabello, Yee, Gfroerer, & Mirza, 2008).

About one-third of our participants currently used at least one tobacco product, and about 5% of the sample currently used at least two products. This latter finding is similar to data recently reported from the Current Population Survey, which indicated that approximately 5% of current cigarette users used some other form of tobacco (Backinger et al., 2008). This represents a population for which comprehensive tobacco cessation efforts are warranted.

We also observed that the correlates of ever use varied by tobacco products. Most prominently, cigarette use was most common among Whites, while snuff and chewing tobacco use was more common among African Americans and American Indians. Similarly, smoked tobacco products were more commonly used by men, whereas smokeless products were more commonly used by women. National data have shown that men are much more likely than women to use smokeless tobacco products. The ethnic pattern of use varies among men and women, with American Indian and white men having higher use rates than other ethnic groups, and American Indian and African American women having higher use rates than other ethnic groups (Centers for Disease Control and Prevention, 1994), The high rate of use of smokeless tobacco among women in this population may be unique to this rural community.

Other demographic and health characteristics were associated with various forms of tobacco use with no clear, consistent pattern. For example, education level was inversely associated with smokeless tobacco use, whereas education level was not related to use of any smoked product. Interestingly, we also found that snuff use was associated with not being in poverty. Further exploration of these data should elucidate this unique pattern of smokeless tobacco use in this population.

We estimated the cumulative lifetime use of each tobacco product, for cigarettes by using the standard "pack years" calculation, and a similar approach for the other products. The average pack years for the sample were 34.5. We also calculated "cigar years" (average 35.7), "pipe years" (average 31.5), "pinch years" (average 89.4) and "chew years" (average 33.1). Since this is a new approach, we are unable to compare our data to other populations. However, our data indicate that, for the most part, users of smokeless tobacco products begin at a very early age, so these data represent extensive exposure to these products in this population.

There were no consistent patterns associated with cumulative lifetime use of tobacco products. Only one association was observed for cumulative lifetime use of smokeless products, that being obesity and chewing tobacco. This is vastly different from the assessment of ever use, in which most variables were correlated with

smokeless tobacco use. This is, to our knowledge, the first attempt to assess cumulative lifetime use of non-cigarette tobacco products. This finding may reflect a lack of clarity in recall of cumulative lifetime use of these products. Other research has documented error in assessing cumulative lifetime exposure to various health risk factors for older adults (Maughan & Rutter, 1997; Simpura & Poikolainen,1983; Steck et al., 2007; van der Vaart,1996).

Our study has a number of strengths. First, we conducted our study in a representative sample of older rural adults from an ethnically diverse population. We had a very high response rate to the study, and used validated measures to assess risk factors and outcomes. We also included a comprehensive measure of tobacco use, including the use of cigarettes, cigars, pipes, snuff and chewing tobacco. Our main study limitation is that we used a cross-sectional design which is affected by temporality and recall bias; however, we did include a rigorous assessment of cumulative lifetime use of all of these products, which is not widely reported in the literature.

In summary, this analysis showed high rates of tobacco use, especially smokeless tobacco products, among older adults in this rural, ethnically diverse community. Use of more than one product was not uncommon, but was generally limited to less than three. This analysis also showed that the patterns of use of these products varied by demographic and health characteristics, both in the type of tobacco product used and in ever versus cumulative lifetime use.

This study adds an important element to the current tobacco research literature. This is the first attempt to comprehensively assess cumulative lifetime use of cigars, pipes and smokeless tobacco. This approach may help further elucidate the degree to which duration and intensity of use of these products impact morbidity and mortality. This strategy may present challenges, particularly for older adults, in recalling patterns of use across the lifespan, especially since initiation of use can start at a very early age.

Comprehensive assessment of tobacco use can also help identify those populations at greatest risk for tobacco-related morbidity and mortality. Further research should also focus on prevention and cessation interventions that are culturally appropriate for these communities, and take into account the various forms of tobacco used in these populations, including use of multiple tobacco products. Acknowledgement

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