Published in final edited form as:

J Rural Health. 2008 ; 24(1): 84–90. doi:10.1111/j.1748-0361.2008.00141.x.

Tobacco Use Among the Amish in Holmes County, Ohio

Amy K. Ferketich, PhD¹, Mira L. Katz, PhD, MPH^{2,3}, Ross M. Kauffman, BS¹, Electra D. Paskett, PhD^{1,3}, Stanley Lemeshow, PhD⁴, Judith A. Westman, MD⁵, Steven K. Clinton, MD, PhD⁶, Clara D. Bloomfield, MD³, and Mary Ellen Wewers, PhD, MPH^{2,3}

¹Division of Epidemiology, College of Public Health, The Ohio State University, Columbus, Ohio.

²Division of Health Behavior and Health Promotion, College of Public Health, The Ohio State University, Columbus, Ohio.

³Comprehensive Cancer Center, The Ohio State University, Columbus, Ohio.

⁴Division of Biostatistics, College of Public Health, The Ohio State University, Columbus, Ohio.

⁵Division of Human Genetics, The Ohio State University, Columbus, Ohio.

⁶Division of Hematology and Oncology, The Ohio State University, Columbus, Ohio.

Abstract

Purpose—The objective of this study was to estimate tobacco use prevalence among the Amish in Holmes County, Ohio, using both self-report and a biochemical marker of nicotine exposure.

Methods—Amish adults (n = 134) were interviewed as part of a lifestyle study. Self-reported tobacco use was measured using standardized questions, and cotinine was measured from a saliva sample. The prevalence of smoking, total tobacco use, and misclassification were estimated separately by gender, and then compared to 2 non-Amish groups. One group was selected from 2 counties contained within the Holmes County Amish settlement (n = 154) and the other was representative of non-Hispanic whites in the United States (n = 4,099).

Findings—No Amish women reported current tobacco use and only 2 reported former use. This was significantly different ($P < .0001$) from the patterns observed among non-Amish in the settlement counties (15.7%) and US white (23.3%) women. The prevalence of tobacco use among Amish men was 17.6% and this was significantly lower than estimates from non-Amish in the settlement counties (38.8%, $P = .04$) and US white (32.2%, $P = .005$) men. No Amish women and only 2 Amish men underreported tobacco use and misclassification was similar in the comparison groups.

Conclusions—Tobacco use is significantly lower among adults in the largest Amish settlement in the world compared to their non-Amish neighbors in Appalachia Ohio and US whites. A strength of this study is that self report was verified with a marker of nicotine, a critical measure to include in any study conducted in a group that stigmatizes tobacco use.

There are approximately 160,000 Amish in North America who live mostly in rural areas in Pennsylvania, Ohio, and other Midwestern states.^{1,2} Individuals living outside the Amish community are familiar with some characteristics of the Amish lifestyle, including their avoidance of telephones and electricity and their use of a horse and buggy for transportation. Typical jobs performed by the Amish include farming and woodworking; however, Amish

men also work in manufacturing jobs. The lifestyle of the Amish is largely influenced by the Ordnung, which is a set of rules dictating what is permitted and what is forbidden in their culture.^{1,2} These rules vary among Amish church districts and are periodically reviewed and revised.

The Holmes County Amish settlement, with approximately 24,000 members, is the largest in the world.¹ This settlement is centered in Holmes County, Ohio, but Amish can also be found in the surrounding counties. Holmes County is 1 of the 29 Appalachian counties in Ohio and, according to the 2000 US Census, 89% of the households in the county are in rural areas.³ Lower cancer incidence rates have been reported among Holmes County Amish adults compared to non-Amish adults in Ohio.⁴ In this cancer incidence study, men and women from 92 households randomly selected from the Holmes County Amish Directory were interviewed and reported on cancer occurrences in their extended families. The estimated age-adjusted cancer incidence rate for all cancers was 55% of the age-adjusted adult rate in Ohio. A reduction was also observed for tobacco-related cancer incidence, which was 37% of the age-adjusted rate for Ohio adults. This latter finding suggested a low prevalence of tobacco use in this group.⁴

Tobacco use is widely discouraged by leaders in many Amish church districts.² However, there is a period of time in the life of an Amish person where some behaviors are more tolerated. Over 80% of youth are baptized into the church as adults and many of them make this decision following a period of rumspringa (“running around”), which occurs between the completion of school (after the 8th grade) and baptism, usually occurring during the early 20s in the life of an Amish person.¹ During this time, Amish interact to a greater extent with the non-Amish world and their social norms are unlike those followed to that point.⁵ According to Reiling,⁵ alcohol use is somewhat common during this period. Depression is also more prevalent during this period and it is likely attributed to the fact that youth are engaging in behaviors that are not part of the Amish culture. In the general population, alcohol use and depression among youth are related to tobacco use.⁶ Thus, if the Amish develop an addiction to nicotine during rumspringa, it is not clear if the strong adult Amish cultural influence will change the behavior.

There have been few studies that have examined tobacco use among the Amish. In 2003, a face-to-face version of the Behavioral Risk Factor Surveillance System (BRFSS) survey was conducted among Holmes County Amish adults and the estimated prevalence of tobacco use was low: 13% (95% confidence interval 7%-19%) among males and 0% among females.⁷ Biochemical verification of the self-reported behavior with a marker of nicotine exposure, such as cotinine, was not included in the BRFSS. In most non-diseased populations little is gained with biochemical verification, as there is generally good agreement between the self-report and a biological marker.⁸ However, in populations where tobacco use is stigmatized there may be a more marked difference between self-reported tobacco use and a true marker of tobacco exposure.^{8,9}

No current estimates of biochemically verified tobacco use are available for the Amish, which is important from a public health perspective because it is not known if they could benefit from prevention and cessation programs. The objectives of this study were to estimate the self-reported and cotinine-verified prevalence of tobacco use among Amish males and females and to estimate the extent of tobacco use misclassification. It was hypothesized that Amish men and women would use tobacco at a significantly lower rate than the general population.

Methods

The research protocol and consent procedures were approved by the Institutional Review Board at The Ohio State University. The data were collected as part of an in-person survey that was conducted with Holmes County Amish adults to examine cancer-related lifestyle behaviors in an attempt to explore reasons why cancer rates are lower among the Amish. The lifestyle survey was a follow-up to the cancer incidence study described above.⁴ The principal investigator of that study (JAW) worked with local bishops and Amish leaders for more than 1 year in order to gain their trust and approval for the research. The 92 randomly selected households included in the cancer incidence study were revisited and the adult heads of household were asked to complete a face-to-face survey that lasted approximately 2 hours. They were told that a variety of behaviors, including tobacco use, would be assessed. An attempt was made to locate individuals who had moved. If the residents died or moved out of the community, then the current residents of the household were recruited if they were Amish. For households that no longer contained an Amish individual and also for households that refused to participate, replacements were randomly sampled from the same Amish Church District listed in the Amish Directory in order to maintain the target sample size.

The male and female heads of household were typically interviewed at the same time by different interviewers. In most cases male interviewers administered the survey to men and female interviewers to women. Couples were asked to complete the survey in different rooms without other family members present, but this did not always happen. It was often the case that a structural barrier did not divide the rooms where the interviews were conducted. The interviewers were instructed to note the following: (1) the presence of additional family members during the entire interview or if the other interviewer and participant could be heard; and (2) the presence of family members during part of the interview.

Amish participants were interviewed during Summer 2004 and were provided with a \$25 gift card after completion of the interview in appreciation for their time. The tobacco items on the questionnaire were taken directly from the National Health and Nutrition Examination Survey (NHANES).¹⁰ These standard questions allowed individuals to be classified as never smokers (never smoked at least 100 cigarettes), former smokers (smoked at least 100 cigarettes, but not currently smoking), and current smokers (smoked at least 100 cigarettes and smokes on some days or daily). Additional questions were asked about other tobacco use (cigars, pipes, and smokeless tobacco).

Self-reported tobacco use was biochemically verified with salivary cotinine, which is the major metabolite of nicotine and has become the standard marker of nicotine exposure.¹¹ During the consent process, all participants were asked to provide a saliva sample following completion of the survey. They were told that the saliva would be analyzed for a marker of tobacco exposure. Sali-saver kits® (ALPCO, Wynham, N.H.) were used to collect the sample, and those who provided saliva received an additional \$5 incentive.

A biochemically verified current tobacco user was defined as an individual with a salivary cotinine concentration ≥ 15 ng/mL.⁸ This cut-point results in a sensitivity and specificity that are over 95%. The cotinine levels were used to correctly classify the self-reported never smokers and former smokers who misclassified their status. Misclassification, defined as a discrepancy between self-reported and biochemically verified tobacco use status among self-reported never and former smokers only, occurred when an individual reported being a never or former smoker but then had a positive cotinine concentration. The cotinine-verified tobacco and smoking variables were created the following way: (1) self-reported current

tobacco users, or current smokers, were defined as current users irrespective of the cotinine level because cotinine is typically used to *biochemically verify* non-smoking status;⁸ and (2) self-reported never and former tobacco users and smokers were re-classified as current users if the cotinine concentration was 15 ng/mL or higher.

The Amish were compared to 2 groups, one of which was a non-Amish sample selected from Holmes County and a neighboring county that is part of the Amish settlement. Many of the participants, particularly in Holmes County, lived very close to the Amish, and therefore this comparison group provided some information about whether the Amish tobacco use patterns were similar to those of the individuals who lived around them. The non-Amish households were randomly chosen from the county auditors' database, and the methods that were used to recruit Amish respondents were again employed for the non-Amish participants. The lifestyle survey developed for the Amish study was slightly modified (religion and schooling items were revised) and administered using face-to-face interviews with non-Amish adults during Summer 2005. Only individuals who did not grow up in an Amish household were included in the sample.

The second comparison group was from the general population of the United States and the data for this group were obtained from the 1999-2002 NHANES, which is a large survey conducted annually by the National Center for Health Statistics. Data are released every 2 years and the 2 most recent waves were included in this analysis. Only data from non-Hispanic whites were used in the comparison for 2 reasons: (1) the Amish are non-Hispanic whites and tobacco use rates differ by racial and ethnic groups; and (2) racial differences in cotinine metabolism may have an influence on the results.¹²

For each comparison group, the following were estimated: (1) current self-reported smoking and total tobacco use; (2) biochemically verified current smoking and total tobacco use; and (3) misclassification of tobacco use.

Statistical Analyses

Descriptive statistics were computed for Amish and non-Amish by gender. Next, self-reported smoking status and total tobacco use prevalence estimates were calculated separately for the Amish and each comparison group by gender. Among ever users of tobacco, the mean age at which regular use began and the average number of years of tobacco use were estimated. Cotinine-verified current smoking and total tobacco use estimates were also calculated and then used to estimate misclassification. These analyses were limited to participants who agreed to provide a saliva sample. All reported estimates were age-adjusted using the direct method and the 2000 Standard Population for adults age 20 and older.¹³ A Z-test was used to test for significant differences between the Amish and each comparison group. The self-reported smoking and tobacco use outcomes included 3 levels (never, former, and current). Because the data are presented as age-adjusted prevalence estimates, simple chi-square tests could not be used to compare the Amish to each comparison group. Therefore, separate Z tests were performed and the first one involved comparing the prevalence estimate of never users between the Amish and each group, by gender. The second was performed after conditioning on having ever smoked/used tobacco and its objective was to test for differences with respect to the prevalence of current use. The stratification and clustering features of the sampling plan were accounted for in analyses using NHANES data and all data were analyzed using SAS v9 software (SAS Institute Inc., Cary, N.C.).

Results

Letters were sent to a total of 112 eligible Amish households. Adults from 75 households agreed to participate ($n = 134$), giving a response rate of 67%. All Amish women were interviewed by female interviewers, while 75% of Amish men were interviewed by male interviewers. With respect to the interview setting, 45% of the interviews were conducted without another family member present and without interruption, 34% were conducted when another family member was either in the room the entire time or close by so that the other person could hear the interview, and 21% were periodically interrupted by another family member. For the non-Amish comparison group, adults in 98 out of the 422 eligible households participated ($n = 154$), giving a 22% response rate. Adults in only 266 households were contacted (residents from the other households were never home) and the agreement rate, defined as the percentage of contacted households that agreed to participate, was 37%. The 1999-2002 NHANES response rates were 76% and 80% for the first and second wave, respectively.

Saliva samples were obtained from 86% of the Amish (115 total, 51 males, and 64 females) and 83% of the non-Amish (128 total, 48 males, and 80 females). Among the 19 Amish participants who did not provide saliva samples there were 10 self-reported never users of tobacco, 3 self-reported former users, and 6 self-reported current users. The 26 non-Amish comparison group participants who refused to provide a saliva sample consisted of 11 self-reported never users of tobacco, 5 self-reported former users, and 10 self-reported current tobacco users.

Table 1 lists the descriptive statistics for the Ohio Amish and non-Amish comparison group participants. The prevalence estimates of self-reported smoking and total tobacco use, which included pipes, cigars, and smokeless tobacco, are presented in Table 2. Among men, the Amish were not significantly different from men in the non-Amish comparison group or US whites with respect to never having smoked or used tobacco. The prevalence estimates of current smoking and total tobacco use were significantly lower among Amish men compared to US whites (7.3% vs 25.5%, $P < .0001$; and 17.6% vs 32.2%, $P = .005$, respectively). When compared to non-Amish men in the settlement counties, only the prevalence of current total tobacco use was significantly lower among the Amish (38.8% vs 17.6%, $P = .04$). The prevalence of total tobacco use was higher than the prevalence of smoking alone, which suggests that men are using other forms of tobacco, in particular smokeless tobacco (results not shown).

There were no Amish women who reported current smoking or current tobacco use and only 2 Amish women reported having formerly used tobacco. Among the non-Amish women in the settlement counties, the prevalence of smoking was identical to the prevalence of total tobacco use, 15.7%, whereas among US whites, the prevalence of total tobacco use was slightly higher than that of smoking alone. This suggests that few women used other forms of tobacco, such as cigars or chewing tobacco. The prevalence of never use was significantly higher and the prevalence of current use was significantly lower among Amish women compared to both the non-Amish women in the settlement counties and US whites.

Information on age at initiation and number of years of tobacco use is presented in Table 2 for men only due to the low prevalence of ever use among Amish women. Amish men were significantly younger when they began using tobacco compared to US whites (17.2 vs 18.1 years, $P = .05$). However, among former users of tobacco, the Amish used tobacco for a significantly shorter period of time compared to US whites (13.3 vs 18.6 years, $P = .002$).

Misclassification prevalence estimates were extremely low among all groups and there were no significant differences between any of the groups (Table 2). All Amish women were correctly classified, whereas 1 non-Amish woman from a settlement county and 1.8% of US women were misclassified as not currently using tobacco. Only 2 Amish men were misclassified as non-users, giving misclassification percentages of 3.0% for smoking and 2.6% for total tobacco use. No non-Amish men from the settlement counties were misclassified and a small percentage of US white men were misclassified as non-users of total tobacco and nonsmokers (2.9% and 3.3%, respectively). Among self-reported tobacco users, 1 Amish male (a pipe smoker) and 1 non-Amish male (a cigar smoker) had cotinine levels below the cut-point.

Discussion

Prior to this study, there were no reports in the literature that documented tobacco use among the Amish with a biochemical marker of nicotine exposure. The findings support the a priori hypothesis that tobacco use among the Amish is less prevalent compared to their non-Amish neighbors and the general population of US Whites. Different patterns emerged for men and women; the prevalence of never use was significantly higher and the prevalence of current use was significantly lower among Amish women only. Amish men were not different from both comparison groups with respect to the prevalence of never users; however, there was a lower prevalence of current tobacco users among the Amish. These results suggest that the Amish cultural proscription on tobacco use may influence behavior, which is similar to results from other religious groups that discourage tobacco.¹⁴

The prevalence of misclassification was low among the Amish and it did not differ from the prevalence among the comparison groups. Only 2 Amish men underreported tobacco use in this study, one who was interviewed in the same room as his wife and one who was interviewed in a room adjacent to his wife and she could hear the interview. This suggests that even though it is a socially stigmatizing behavior in many Church Districts, the Amish correctly reported tobacco use. The findings of no tobacco use and no misclassification among Amish women are in contrast to those from Southeast Asian women, another group that lives in a male-dominated society that discourages tobacco use among women.⁹

Interestingly, while Amish men were slightly younger when they initiated regular tobacco use compared to US whites, former smokers quit after having used tobacco for a significantly shorter period of time (13.3 vs 18.6 years). This pattern supports the long-held tradition that Amish youth, particularly the males, may experiment with tobacco during rumspringa. However, most will quit using tobacco sooner than their non-Amish counterparts. On the other hand, these findings also speak to the addictive nature of nicotine because the duration of rumspringa (5-9 years) appears to be shorter than the duration of tobacco use. No questions about tobacco limitations proscribed in the participant's Church District were included in the questionnaire; therefore, it is not known if the continued users were from districts that had more relaxed rules regarding tobacco use.

The low prevalence of tobacco use among those who made the decision to be baptized into the Amish church may account in part for the observed lower cancer incidence rate, as described in the introduction. The data on tobacco use from the present study are a critical piece of information that may help interpret the cancer incidence data. We are currently analyzing data on other lifestyle behaviors among the Amish, including physical activity and cancer screening, which may also provide information to help explain the reduced cancer incidence among the Amish.

Strengths of this study include the use of a biochemical marker of nicotine exposure to estimate the prevalence of tobacco use and the use of interviewers to collect the saliva samples in the field. The interviewers received training on sample collection and on the few occasions when a sufficient amount of saliva was not collected, an interviewer returned to the participant's home to obtain another sample.

There are several limitations to this study. First, while the response rate among the Amish households was moderately high (67%), there were some Amish who refused to participate. In many cases these individuals reported that they were too busy to complete the survey. The response rate was much lower (22%) among the non-Amish in the settlement counties. Unlike the Amish, who were usually at home, the non-Amish comparison group individuals were extremely difficult to reach. Limited resources allowed us to make a maximum of 3 attempts to reach each household. Another limitation relates to the fact that only 1 Amish community was sampled. While this is the largest Amish community, caution should be taken in assuming that these findings can be generalized to other Amish. On a similar note, 1 Amish order that resides in Holmes County was not part of the sampling frame. This very strict and conservative order does not list its members in the Holmes County Amish Directory and they account for approximately 20% of the Amish in this region.¹⁵ It is not known what the tobacco use rates are among these Amish, as there are no published studies examining this question.

In conclusion, tobacco use is significantly lower among Amish men and women in the Holmes County Amish settlement compared to their non-Amish neighbors and US whites. The strength of this study is that self-reported tobacco use was biochemically verified with a marker of nicotine. This is a critical measure to include in any study of tobacco in a group that has proscriptions regarding its use.

Acknowledgments

Funding sources: (1) NIH 1 P50 CA015632-01; (2) NIH 5 P30 CA16058-31; and (3) Coleman Leukemia Research Foundation.

References

1. Donnermeyer, JF.; Kreps, GM.; Kreps, MW. Lessons for Living: a Practical Approach to Daily Life From the Amish Community. Carlisle Press; Sugarcreek, Ohio: 1999.
2. Hostetler, JA. Amish Society. 4th Edition. The Johns Hopkins University Press; Baltimore, Md.: 1995.
3. U.S. Census Bureau. [Accessed August 13, 2006] Census 2000 Summary File 1 (SF 1) 100-Percent Data. Available at: http://factfinder.census.gov/servlet/DTGeoSearchByListServlet?ds_name=DEC_2000_SF1_U&_lang=en&_ts=173570389546
4. Westman JA, MacEachern SN, Ferketich AK, et al. Low cancer incidence rates in Ohio Amish. *Am J Hum Genet.* 2003; 73:373.
5. Reiling D. The Simmie side of life: old order Amish youths' affective response to culturally prescribed deviance. *Youth Soc.* 2002; 34:146–171.
6. U.S. Department of Health and Human Services. Preventing Tobacco Use Among Young People: A Report of the Surgeon General. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health; Atlanta, Ga.: 1994.
7. Holleran Consulting. Holmes County Health District Behavioral Risk Factor Surveillance System Study Executive Summary. Nov 17. 2003
8. SRNT Subcommittee on Biochemical Verification. Biochemical verification of tobacco use and cessation. *Nicotine Tob Res.* 2002; 4:149–159. [PubMed: 12028847]

9. Wewers ME, Dhath RK, Moeschberger ML, et al. Misclassification of smoking status among Southeast Asian adult immigrants. *Am J Respir Crit Care Med*. 1995; 152:1917–1921. [PubMed: 8520755]
10. National Center for Health Statistics. [Accessed June 29, 2006] Sample Person Questionnaire: Smoking and Tobacco Use. Available at: http://www.cdc.gov/nchs/data/nhanes/nhanes_01_02/sp_smq.pdf
11. Jarvis MJ, Tunstall-Pedoe H, Feyerabend C, et al. Comparison of tests used to distinguish smokers from nonsmokers. *Am J Public Health*. 1987; 77:1435–1438. [PubMed: 3661797]
12. Mustonen TK, Spencer SM, Hoskinson RA, et al. The influence of gender, race, and menthol content on tobacco exposure measures. *Nicotine Tob Res*. 2005; 7:581–590. [PubMed: 16085529]
13. Klein, RJ.; Schoenborn, CA. Age Adjustment Using the 2000 Projected U.S. Population. *Healthy People Statistical Notes*, No. 20. National Center for Health Statistics; Hyattsville, Md.: Jan. 2001
14. Merrill RM, Hilton SC, Daniels M. Impact of the LDS church's health doctrine on deaths and conditions associated with cigarette smoking. *Ann Epidemiol*. 2003; 13:704–711. [PubMed: 14599735]
15. Nussbaum, S. *Orders of the Amish*. Spectrum Publications; Orville, Ohio: Oct. 2001

Table 1

Demographic Characteristics of Amish and Non-Amish Participants, by Gender

Characteristic	Men		Women	
	Amish (n = 62)	Non-Amish (n = 64)	Amish (n = 72)	Non-Amish (n = 90)
Mean age (SD)	52.4 ± 13.8	58.8 ± 15.9	52.9 ± 15.1	56.8 ± 15.3
Age range (years)	22-84	24-92	21-89	22-90
Marital status (%)				
Never married	3.2	1.6	0	2.2
Married	95.2	82.5	93.1	74.2
Divorced/Sep	0	14.3	0	9.0
Widowed	1.6	1.6	6.9	14.6
Education level (%)				
<High school (HS)	98.4	12.5	100	12.2
HS degree	1.6	46.9	0	52.2
>HS degree	0	40.6	0	35.6
Always lived in county	61.3	31.3	61.1	34.4
Occupation (%)				
Farmer	19.4	0	0	2.2
Homemaker			97.2	3.3
Other occupation	80.6	100	2.8	94.5

Table 2

Prevalence of Self-Reported Tobacco Use, Misclassification, and Tobacco Use Characteristics Among Amish, Non-Amish, and US Whites, by Gender

	Men			Women		
	Amish (%)	Non-Amish (%)	US Whites [†] (%)	Amish (%)	Non-Amish (%)	US Whites [†] (%)
Self-reported use [‡]						
Smoking						
Never	47.5	38.6	45.4	96.6	57.7***	55.8***
Former	45.2	48.6	29.1	3.4	26.6	21.3
Current	7.3	12.8	25.5***	0	15.7***	22.9***
Total tobacco						
Never	45.1	33.2	36.5	96.6	57.7***	55.2***
Former	37.3	28.0	31.2	3.4	26.6	21.5
Current	17.6	38.8*	32.2**	0	15.7***	23.3***
Misclassification ^{‡‡}						
Current smoking ^{‡‡‡}	3.0	0	3.3	NA	0.7	1.8
Total tobacco use	2.6	0	2.9	NA	0.7	1.8
Tobacco use characteristic						
Age at initiation (years)	17.2 ± 0.4	17.4 ± 0.5	18.1 ± 0.1*			
Years of use—total						
Tobacco						
Former	13.3 ± 1.7	14.0 ± 1.6	18.6 ± 0.2**			
Current	25.9 ± 3.0	23.4 ± 1.9	26.6 ± 0.2			

[†] Estimated using 1999-2002 NHANES data.

[‡] Age-adjusted prevalence estimates calculated using the 2000 Standard Population.

^{‡‡} Estimated among participants who provided a saliva sample.

^{‡‡‡} Estimated among subset of respondents who did not self-report other forms of tobacco.

* *P* .05 for test compared to Amish prevalence (gender specific).

** *P* .01 for test compared to Amish prevalence (gender specific).

*** *P* .0001 for test compared to Amish prevalence (gender specific).