Oral Cancer Incidence Among Smokers and Smokeless Tobacco Users Compared to Nonusers of Tobacco Products - Contemporary Analysis of Cancer Registry Data

Background

Tobacco use has been identified as a risk factor for oral cancer (oral cavity and pharynx, Table 1). However, the differential oral cancer risk among users of cigarettes and smokeless tobacco products has not been well studied. In this study using data from state-wide cancer registries and national surveys, we estimate oral cancer incidence among adult males who were:

- current smokers that had never used smokeless tobacco products (CIG),
- current smokeless tobacco users who had never smoked (ST),
- current dual users of cigarettes and smokeless tobacco (DUAL),
- former smokers who are current smokeless tobacco users (FCIG/CST),
- former smokers and former smokeless users (FCIG/FST), and
- nonusers of cigarettes or smokeless tobacco products (NON)

Data Sources

Oral cancer incidence rates were estimated using Colorado, Florida, North Carolina, and Texas cancer registries (Figure 1) from the years 2014 through 2017 (the most recent 4 years of available data). State-specific population counts by tobacco use status were estimated from the Tobacco Use Supplement to the Current Population Survey.

Analysis

Missing values in tobacco use status in cancer registry data were imputed either by assuming missing at random or using multiple imputation. Poisson regression was used to estimate incidence rate ratios (IRR) by state and age group. A random-effect meta-analysis approach was used to summarize estimates by state and age groups while considering potential heterogeneity using the Mantel-Haenszel model

Results

Cases of oral cancer among adult males 35 years and older with tobacco use data numbered 19,536 in the geographies studied over the covered period (Table 2). Oral cancer rates are listed in Table 3 and IRRs are listed in Figure 2. Assuming missing at random, the pooled oral cancer IRR relative to NON were 3.4 (95% CI = 3.0 to 3.9) for CIG and 1.0 (95% CI = 0.7 to 1.3) for ST, resulting in an IRR of 3.5 (95% CI = 2.5 to 4.9) for CIG relative to ST. Additionally, the IRR of CIG relative to FCIG/CST was 3.8 (95% CI = 2.6 to 5.4) and FCIG/CST relative to FCIG/FST was 1.1 (95% CI = 0.7 to 1.6). The corresponding multiple imputation-based estimates relative to NON were 3.6 (95% CI = 3.2 to 4.1) for CIG and 1.4 (95% CI = 1.1 to 1.9) for ST, resulting in an IRR of 2.6 (95% CI = 2.0 to 3.3) comparing CIG relative to ST. The IRR of CIG relative to FCIG/CST was 2.4 (95% CI = 1.8 to 3.1) and FCIG/CST relative to FCIG/FST was 1.4 (95% CI = 1.0 to 2.1). These estimates should be considered in the context of certain limitations, such as the estimates were not adjusted for other potential confounding variables (e.g., alcohol intake and other lifestyle factors, duration of tobacco use, and other tobacco product use) due to the lack of such information in data sources.

Conclusion

Our population estimates based on state cancer registry data demonstrate that current smokeless tobacco users with or without smoking history had a substantially lower oral cancer risk than current smokers. Also, males who stopped smoking and currently used smokeless tobacco did not have a substantially higher oral cancer risk than those who stopped smoking and smokeless tobacco use. While causal relationships cannot be concluded, the large sample size in this contemporary analysis suggests that oral cancer risks among smokers may be reduced by switching to smokeless tobacco products; however, quitting all tobacco use is the optimal path for reducing oral cancer risks.

Current smokeless tobacco users with or without smoking history had a substantially lower oral cancer risk than current smokers.

Table 1. Oral cancers included in incidence rates

	Lip	
	Tongue	
Lip. oral	Salivary Gland	
	Floor of Mouth	
cavity,	Gum and Other Mouth	CO30-
& pharynx ICD codes	Nasopharynx	
	Tonsil	
	Oropharynx	
	Hypopharynx	
	Other and ill-defined	

Figure 1. Map of states included



Table 2. Case counts and demographic information from four cancer registries, Males 35+, 2014-2017

	Number	Percent		Number	Percent
Oral cancers	26,666	100.0	Age Group		
with tobacco data	19,536	73.3	35-44	763	3.9
State			45-54	3,445	17.6
Colorado	1,504	7.7	55-64	6,737	34.5
Florida	8,779	44.9	65-74	5,532	28.3
North Carolina	3,542	18.1	over 75	3,059	15.7
Texas	5,711	29.2	Ethnicity		
Tobacco Group			and Race		
CIG	4,770	24.4	Hispanic	1,888	9.7
ST	190	1.0	White Non-	15646	80.1
DUAL	153	0.8	Hispanic	15,040	
FCIG/CST	136	0.7	Black Non-	1 500	7.7
FCIG/FST	443	2.3	Hispanic	1,500	
NON	6,325	32.4	Other /	404	2.5
Other*	7,414	38.0	Unknown	494	

Note: The "Other" tobacco group consists almost entirely of former smokers and is omitted from this analysis.

Table 3. Oral cancer incidence rates by tobacco use, Males 35+, 2014-2017

	Rate per 100,000 (95% Confidence Interval)							
	CO	<u>FL</u>	NC	TX	Combined			
CIG	81.6 (73.4-90.7)	86.1 (82.6-89.8)	83.0 (77.9-88.5)	65.2 (62.1-68.4)	74.0 (71.9-76.2)			
ST	22.7 (15.8-32.5)	17.3 (12.9-23.1)	16.8 (12.9-22.1)	24.0 (20.2-28.5)	20.6 (18.3-23.3)			
DUAL	41.6 (26.0-66.6)	73.3 (57.4-93.6)	28.6 (21.6-37.9)	36.7 (29.2-46.1)	40.6 (35.4-46.6)			
FCIG/CST	14.0 (8.8-22.3)	12.7 (8.9-18.0)	23.2 (17.9-30.0)	22.0 (17.6-27.4)	18.8 (16.3-21.8)			
FCIG/FST	7.5 (5.5-10.1)	29.7 (26.1-33.8)	25.7 (21.9-30.1)	12.6 (10.8-14.7)	18.0 (16.6-19.6)			
NON	22.7 (20.8-24.7)	23.1 (22.2-24.0)	18.9 (17.7-20.2)	24.6 (23.7-25.5)	22.1 (21.5-22.6)			

C000-C009 C019-C029 C079-C089 C040-C049 -CO39, CO50-CO59, CO60-CO69 C110-C119 C090-C099 C100-C109 C129, C130-C139 C140, C142, C148

Figure 2a-e. Incidence rate ratio forest plots with analysis assuming missing at random in the left pane and using multiple imputation in the right pane. The red dotted reference line represents the overall estimate of each plot.

a. Smokers relative to nonusers (CIG rel. NON)



c. Smokers relative to smokeless tobacco users (CIG rel. ST)



e. Former smoker/current smokeless users relative to former smoker/former smokeless users (FCIG/CST rel. FCIG/FST)



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b. Smokeless tobacco users relative to nonusers (ST rel. NON)



d. Smokers relative to former smoker/current smokeless users (CIG rel. FCIG/CST)



