Mortality Among Male Cigar and Cigarette Smokers in the U.S.

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Abstract

Background. Cigars and cigarettes are both smoked, but much less is known about the former's long-term health effects, due to its low prevalence and infrequent collection of cigar information in national surveys.

Purpose. We conducted a follow-up mortality study of cigar-smoking men age 40-79 years in National Health Interview Surveys (NHIS). We utilized

Methods. We used pooled NHIS files linked to the National Death Index to obtain follow-up from year of interview to year of death or December 31, 2015. We developed categories of cigarette and cigar smoking that accommodate dual and former use of both products. We used Cox proportional hazards models, adjusted for age, race/ethnicity, marital status, education, income, health status, body mass index, and region to estimate hazard ratios (HRs, 95% confidence intervals, CI) for mortality from all causes, heart diseases, malignant neoplasms, cerebrovascular disease, chronic lower respiratory diseases and two mutually exclusive categories: smoking-related and other diseases.

Results. There were 14,628 deaths from all causes, including 3,420 never tobacco users, 3,266 exclusive smokers, and 176 exclusive cigar users. The latter had significantly increased mortality only from chronic lower respiratory diseases (HR = 2.60, CI = 1.04 – 6.50), which was based on 6 deaths. We found no statistically significant evidence among exclusive cigar smokers of increased mortality from any other cause.

Conclusions. This study provides evidence that male cigar smokers had elevated mortality risks. However, after accounting for cigarette smoking, we found significantly increased mortality only for chronic lower respiratory diseases.

Background

Cigarettes were the most popular tobacco product in the 20th Century, and the most deadly. The risks of cigarette smoking are proportional to the amount of smoke inhaled and the duration (years, decades) of exposure, and the death toll from cigarette smoking is high. Every year, 480,000 adults die from smoking-related diseases. For the past 50 years, the American cancer 'epidemic' has primarily consisted of one disease, cancer of the lung, owing to one dominant lifestyle factor – cigarette smoking.

Cigar use also involves inhaling smoke, but much less is known about its health effects. This is due to the low prevalence of cigar smoking and infrequent collection of cigar information in national surveys. For example, the prevalence of cigar use in 2015 among American adult men and women was 4.1% and 0.6%, respectively (1). In addition, National Health Interview Surveys (NHIS), the primary instrument used by the Centers for Disease Control and Prevention (CDC) to estimate US smoking rates, collected information about cigar use in only nine of the last 30 years.

Two follow-up mortality studies of cigar smoking have recently been published. The first was authored by FDA investigators last year (2), and it involved 1,139 current cigar smokers in U.S. Census Bureau surveys in 1985 and 1992–2011, stratified by daily and non-daily use. Multivariable adjusted results showed significantly elevated all-cause mortality for daily users (Hazard Ratio = 1.22, 95% confidence interval = 1.04–1.44), in addition to increases in smoking-related cancers, lung cancer and chronic obstructive pulmonary disease.

The second study was from investigators at the National Cancer Institute, and it involved 728 exclusive current cigar smokers from selected NHIS years linked to the National Death Index (3). The authors did not report significant increased mortality for all causes or specific diseases. However, that study included adults of any age, which includes many younger participants (less than age 40 years) who are at little risk of death from any causes for at least 20 years of follow-up.

We conducted a similar follow-up mortality study of cigar-smoking NHIS participants, but we limited our study population to men 40–79 years of age. In addition, we utilized categories of cigarette and cigar smoking that accommodate dual and former use of both products, which are common usage patterns.

Methods
Data

This study used pooled files from the Integrated Public Use Microdata Series (IPUMS) for NHIS surveys with information on cigarette and cigar smoking (1987, 1991, 1992, 1998, 2000, 2005 and 2010) and linked to the National Death Index (NDI) (4) to obtain follow-up from year of interview to year of death or end of follow-up, December 31, 2015. Details of the data linkage can be found in our previous study (5).

Measures

Tobacco Status

The main predictor of mortality outcomes was cigarette and cigar smoking status at the survey enrollment. Never cigarette smokers had never smoked 100 cigarettes in their lifetime. Current cigarette smokers had smoked at least 100 cigarettes and smoked every day or some days at the time of the survey. Former cigarette smokers had smoked 100 cigarettes but did not smoke at the time of the survey.

We defined never cigar smokers as those who had never smoked at least 50 cigars in their lifetime. Current cigar smokers had smoked at least 50 cigars and smoked every day or some days at the time of the survey. Former cigar smokers had smoked at least 50 cigars but did not smoke at the time of the survey.

Next, we constructed 9 categories using cigarette and cigar status: 1- never smokers (never cigarette or cigar), 2- never cigarette and current cigar (i.e. exclusive cigar), 3- never cigarette and former cigar, 4- current cigarette and never cigar (i.e. exclusive cigarette), 5- current cigarette and cigar (i.e. dual users), 6- current cigarette and former cigar, 7- former cigarette and never cigar, 8- former cigarette and current cigar, and 9- former for both products.

Individual characteristics

We included the following characteristics as confounders: age, race/ethnicity (non-Hispanic white, non-Hispanic black, other), marital status (never married, married, divorced/separated, widowed), educational attainment (< high school, high school, some college, college and higher), family income ($0-$34,999, $35,000-$74,999, ≥$75,000), self-reported heath status (excellent, very good, good, fair, poor) and body mass index (BMI) categories (normal weight, 18.5 ≤ BMI < 25; underweight, BMI < 18.5; overweight, 25 ≤ BMI < 30; obese, BMI ≥ 30). We also included region of residence (Northeast, South, Midwest, West) as well as survey year to capture any variations due to unobserved characteristics.

Mortality outcomes

We examined all-cause and cause-specific mortality from heart diseases (I00-I09, I11, I13, and I20-I51), malignant neoplasms (C00-C97), chronic lower respiratory diseases (J40-J47), and cerebrovascular disease (I60-I69). In addition, we combined those diseases with diabetes mellitus (E10–E14) and influenza/pneumonia (J09–J18) to make a category called smoking-related diseases similar to, but somewhat broader than those recognized by the Surgeon General (6). This category was mutually exclusive and exhaustive with respect to all other causes, which consisted of accidents (V01-X59,Y85-Y86), Alzheimer's disease (G30), nephritis, nephrotic syndrome and nephrosis (N00-N07, N17-N19, N25-N27) and all other residual causes (5).

Study population

The total number of participants for all NHIS survey years was 752,153. Our analyses were restricted a priori to men age 40–79 years (n = 52,710). The prevalence of cigar smoking among women during these survey years was extremely low (1). At younger ages tobacco use is less stable, and mortality is uncommon.

About 97% of these men (n = 51,062) were eligible for mortality linkage. Men who died the same year as their survey enrollment (n = 366) accrued no person-years, so they were not eligible for analysis. We also excluded men with incomplete information on cigarette or cigar use or demographic characteristics (i.e. race/ethnicity, education, marital status, and self-reported health status.), so the final sample for our analyses was 43,148 men (age 40–59 years, n = 27,192 and age 50–79 years, n = 15,956) with 587,887 person-years and 14,628 deaths.

Statistical analysis

Cox proportional hazards models were used to examine the associations between cigar status and mortality outcomes based on underlying causes of death from the 10th revision of International Statistical Classification of Diseases and Related Health Problems (ICD-10)(7), reported as hazard ratios (HRs, with 95% confidence intervals, CI) with never smokers as the referent group. Follow-up, in years between survey enrollment and death or survival until December 31, 2015, ranged from 1 to 28 years (mean = 13.6 years; median = 14 years, standard deviation = 7.3 years).

We first estimated HRs adjusted for age only, then for age, race/ethnicity, marital status, education, income, region, and survey year as described previously (5). The final model added BMI categories and self-reported health status. The rationale for the final model is that BMI and health status may be affected by tobacco status, but these covariates also adjust for other differences that may be correlated with tobacco use and with mortality (i.e. relevant confounders). Notably, we included an indicator for missing family income and BMI categories in regression models. We applied sample weights adjusted for NDI linkage eligibility in all models. Results are reported separately for younger (ages 40–59 years), older (age 60–79 years) and pooled age groups.

Results

Descriptive statistics

Table 1 contains demographic and health characteristics of all men in the study (n = 43,148), according to cigarette and cigar status. There were 2,164 current cigar smokers; the largest number (n = 880, 41%) were also current cigarette smokers, followed by former (n = 684, 32%) and never cigarette smokers (i.e. exclusive cigar, n = 600, 28%). Compared with never users, current cigar smokers were more likely to be non-Hispanic white, divorced/separated and obese.

Table 1
Demographic characteristics (unweighted percentage) of men age 40–79 years enrolled in NHIS 1987, 1991-92, 1998, 2000, 2005, and 2010, according to cigarette and cigar use

	Never cigarette smokers			Current cigarette smokers			Former cigarette smokers			Total
	Never cigar smokers	Current cigar smokers	Former cigar smokers	Never cigar smokers	Current cigar smokers	Former cigar smokers	Never cigar smokers	Current cigar smokers	Former cigar smokers	
Age in year	54.1	54.3	59.9	52.7	51.9	55.1	59.0	56.0	60.8	55.8
Race/ethnicity										
Non-Hispanic White	69.0	77.7	85.5	68.7	76.0	84.6	76.4	87.3	89.4	74.2
Non-Hispanic Black	12.7	14.8	8.5	17.7	13.9	9.6	10.4	7.9	5.6	12.2
Hispanic and other race	18.3	7.5	6.0	13.6	10.1	5.8	13.2	4.8	5.1	13.6
Marital status										
Never married	13.0	9.8	7.1	13.8	12.3	7.8	7.4	7.6	4.6	10.5
Married	66.8	62.3	71.3	52.0	51.2	56.4	69.0	66.7	71.9	64.3
Divorced/separated	16.0	20.2	14.7	29.2	31.3	28.9	16.5	19.7	15.8	19.6
Widowed	4.1	7.7	6.9	5.1	5.2	6.9	7.1	6.0	7.6	5.7
Educational attainment										
Less than high school	16.0	17.7	16.9	25.8	27.3	25.4	22.3	12.7	22.4	20.7
High school	27.1	24.8	27.4	37.3	33.6	36.9	31.3	31.9	31.8	31.2
Some college	20.7	21.7	20.6	23.0	24.0	22.9	22.4	22.5	22.0	21.9
College and higher	36.2	35.8	35.1	14.0	15.1	14.7	24.0	32.9	23.8	26.3
Family income										
$0–34,999	41.5	39.8	41.7	55.0	55.3	55.9	46.5	38.2	47.5	46.7
$35,000–74,999	32.0	34.5	35.6	28.6	26.5	29.2	32.0	34.2	33.8	31.4
$75,000+	18.7	18.5	13.9	8.2	10.6	7.4	12.6	20.5	11.0	13.7
Missing income	7.9	7.2	8.8	8.2	7.6	7.5	9.0	7.2	7.6	8.2
Self-reported health										
Excellent	32.7	34.3	23.7	20.0	16.3	17.8	24.8	30.1	22.4	26.1
Very good	30.9	32.3	31.0	27.2	26.7	26.0	28.1	31.1	28.1	29.0
Good	24.9	22.3	31.8	29.8	31.9	31.8	27.8	27.6	29.6	27.6
Fair	8.5	8.2	10.2	15.9	17.7	16.2	13.6	7.9	13.9	12.3
Poor	3.0	2.8	3.4	7.0	7.4	8.1	5.7	3.2	5.9	5.0
BMI categories										
Normal weight	28.1	22.0	28.8	38.0	31.1	39.1	26.6	20.8	23.7	29.6
Underweight	0.2	0.0	0.1	0.9	1.5	1.5	0.3	0.1	0.2	0.5
Overweight	46.0	48.5	45.7	41.3	41.1	37.7	47.9	49.9	48.2	45.4
Obese	21.1	26.2	23.2	15.6	21.5	18.4	21.8	26.5	25.2	20.7
Missing BMI	4.5	3.3	2.2	4.1	4.8	3.4	3.4	2.8	2.7	3.8

Participants with missing cigar status, race/ethnicity, educational attainment, marital status or self-reported health status are excluded.

	Never cigarette smokers			Current cigarette smokers			Former cigarette smokers			Total
	Never cigar smokers	Current cigar smokers	Former cigar smokers	Never cigar smokers	Current cigar smokers	Former cigar smokers	Never cigar smokers	Current cigar smokers	Former cigar smokers	
Region										
Northeast	19.7	24.7	20.4	18.3	15.9	14.8	20.3	21.9	19.4	19.4
South	34.2	30.3	34.6	38.1	39.3	34.9	34.7	30.0	33.5	35.0
Midwest	23.0	27.2	27.4	24.2	22.6	28.9	22.6	31.0	27.3	24.0
West	23.1	17.8	17.6	19.3	22.2	21.5	22.5	17.1	19.8	21.5
Observations	14,972	600	955	8329	880	1670	11152	684	3906	43148

Participants with missing cigar status, race/ethnicity, educational attainment, marital status or self-reported health status are excluded.

Smoking status and mortality

Figure 1 presents the adjusted HRs for mortality from all causes among men who were cigarette and/or cigar smokers, according to age group. Compared with never users, both younger and older current and former exclusive cigar smokers had no statistically significant elevated mortality. Current cigarette smokers, regardless of cigar status, had the highest HRs ranging from 2.06 to 2.34, all statistically significant. Former cigarette smokers generally had significant excess all-cause mortality, ranging from 15–55%.

Figure 2 shows that current and former exclusive cigar smokers, regardless of their age, showed no statistically significant excess mortality for heart diseases, malignant neoplasms, cerebrovascular disease, smoking related diseases, and other causes. The only significantly elevated HR for current exclusive cigar smokers was chronic lower respiratory diseases in combined age groups (HR = 2.6, CI = 1.04−6.50, Supplemental Table 1).

In contrast, current cigarette smokers, regardless of their cigar use and age, had elevated mortality for heart disease (HRs from 1.53 to 2.90), malignant neoplasms (HRs from 2.45 to 3.86), chronic lower respiratory diseases (HRs from 7.70 to 31.53), smoking related diseases (HRs from 2.39 to 2.71), and other causes (HRs from 1.53 to 1.89), compared with never smokers. For cerebrovascular disease, only younger current exclusive cigarette smokers had statistically significant elevated mortality (HR = 1.79, CI = 1.14−2.81).

Similarly, we observed some evidence among former cigarette smokers in both age groups of increased mortality from heart diseases, malignant neoplasms, chronic lower respiratory diseases, smoking related diseases, and other causes. However, no increase was found for cerebrovascular disease mortality.

Discussion

The main finding of this study is that exclusive male cigar smokers age 40 + years had significantly increased mortality only from chronic lower respiratory diseases (HR = 2.60, CI = 1.04−6.50), which was based on 6 deaths. We found no statistically significant evidence among exclusive cigar smokers of increased mortality from all causes, heart diseases, malignant neoplasms, cerebrovascular disease, smoking related diseases or other causes.

Our findings were similar to those from Inoue-Choi et al. (3). They used restricted NHIS-Linked Mortality Files and found no elevated mortality among exclusive current and former cigar smokers. Current daily cigar smokers had elevated mortality from cancer (HR = 2.27, CI = 1.23 to 4.19). However, the increase was not attributable to cancers of the oral cavity, esophagus, stomach, colorectal, or pancreas. Furthermore, nonsignificant increases in lung and bladder cancer were based on fewer than five deaths.

Another recent study by Christensen et al. (2) used data from the Tobacco Use Supplement to the Current Population Survey (TUS-CPS) linked to the National Longitudinal Mortality Study. It found that exclusive current cigar smokers ages 35−80 years had significantly elevated mortality for all causes (HR = 1.20, CI = 1.03−1.38), all tobacco-related cancers (HR = 1.61, CI = 1.11−2.32) and lung cancer (HR = 3.26, CI =

1.86–5.71). The authors observed that, although most cigar users did not smoke every day, the mortality increases were mainly due to daily users. No excess deaths were found among exclusive former cigar smokers.

Christensen et al. (2) and Inoue-Choi et al. (3) adjusted for only sociodemographic variables and survey years, whereas our models adjusted for more comprehensive confounders such as BMI, health status and geography. More importantly, those studies excluded use of other tobacco products, which eliminates 60% of all current cigar smokers from follow-up (8). Our approach includes the mortality experience of dual current cigar-cigarette users and current-former users of these two products. Our HRs for current and former cigarette smokers, regardless of their cigar use, were similar to those from previous studies by us (5) and others (2,9,10). Dual users had significantly elevated mortality risks for all outcomes except cerebrovascular disease. Former cigarette smokers who smoked cigars at the time of the survey had excess mortality for most causes, but the magnitudes were smaller than current cigarette smokers.

Other factors may be related to the low impact on mortality of cigar smoking in this study. Male cigar smokers over age 40 who never smoked cigarettes are more likely to be consumers of traditional cigars, which tend to be smoked less frequently and in smaller numbers than cigarillos or filtered cigars [10]. Additionally, differences in risk between cigar and cigarette smokers has been attributed for years to differences in inhalation practices (11,12,13). Although these factors might contribute to exclusive cigar smokers' lower mortality compared to cigarette smokers, they do not seem to benefit former cigarette smokers who are current cigar smokers, who had elevated mortality for most diseases.

Our results also mirror those cited in a systematic review on cigars and health outcomes by Chang et al. (14). They defined primary cigar smokers as having had no history of cigarette use. The results were organized according to the number of cigars smoked daily, and two studies reporting all-cause mortality were cited (15,16). The first involved 15,000 primary cigar smokers in the American Cancer Society First Cancer Prevention Survey (15). Primary cigar smokers consuming 1–2 cigars daily had no increased mortality (1.02, 0.97–1.07), but those smoking 3–4 and 5 or more had elevated deaths from all causes (1.08, 1.02–1.15 and 1.17, 1.10–1.24 respectively). In the second study of 250,000 government-insured participants, most of whom were World War I veterans, fewer than 5 cigars per day was associated with no significant increase (1.04, 0.98–1.11) (16).

Similar results for other diseases related to primary smokers of 1–2 cigars per day were cited in the review by Chang et al. (14). For stomach, pancreas and bladder cancer, elevated risks were based on very small numbers of deaths and not statistically significant. Some cancer estimates were elevated, especially mouth/throat, esophagus, larynx and lung, but none were statistically significant. However, an older study by Shapiro et al. (17) using Cancer Prevention Study II (CPS-II) found that cigar smoking men age 30 + years had elevated mortality risk for lung, oral cavity/pharynx, larynx, and esophagus cancer.

Chang et al. (14) observed no increased mortality from coronary heart disease, stroke or emphysema among primary smokers of 1–2 cigars per day, but they did find an excess of deaths from aortic aneurysm (1.82, 1.11–2.81).

There are several limitations with our study. First, NHIS collects information on the use of cigarettes and cigars only once at survey enrollment for each participant. Second, we did not have information on the amount or duration of consumption among current smokers and the number of years since quitting among former smokers. Third, information on alcohol use and preexisting chronic conditions (e.g. diabetes, high blood pressure, high cholesterol), which are risk factors for premature death, was not available consistently after 1997 in NHIS, so we did not include them in our models. Similarly, there was no consistent data on physical activity and diet. Finally, we have limited statistical power and high standard errors due to the low prevalence of cigar use and small numbers of deaths for some outcomes.

Conclusions

This study provides limited evidence that male cigar smokers had elevated mortality risks. After accounting for cigarette smoking, we found significantly increased mortality only for chronic lower respiratory diseases. The paucity of effects is consistent with other studies, and may be related to patterns and frequency among primary cigar smokers.

Abbreviations

NHIS – National Health Interview Survey

HR – hazard ratio

CI – confidence interval

IPUMS – Integrated Public Use Microdata Series

NDI – National Death Index

ICD – International Classification of Diseases and Related Health Problems

BMI – body mass index

CPS – Cancer Prevention Study

TUS-CPS – Tobacco Use Supplement to the Current Population Survey

Declarations

Ethics approval and consent to participate

Ethics approval and consent to participate are not required for analyses involving de-identified public-use datasets from IPUMS.

Consent for publication

Consent for publication is not required for analyses involving de-identified public-use datasets from IPUMS.

Availability of data and material

The datasets analysed during the current study are available in the IPUMS repository at http://doi.org/10.18128/D070.V6.3

Competing interests

Neither author has any financial or other personal relationship with regard to the funding sources or any other stakeholders.

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Authors' contributions

BR conceived the study, and both authors developed the analytic strategy. NP downloaded the data and conducted the analyses; both authors wrote and approved the final manuscript.

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Figures
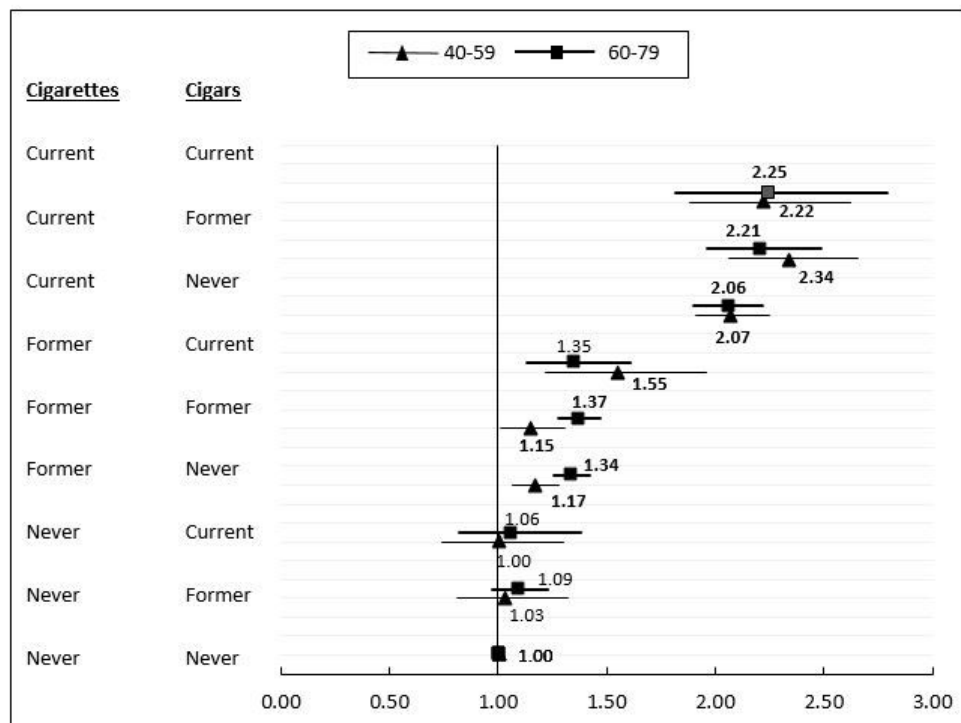
Figure 1

Title: Hazard ratios for all-cause mortality among men age 40-79 years, according to cigarette and cigar smoking status. Legend: Numbers are point estimates, bold represents statistically significant at the p < 0.05 level. Horizontal lines represent 95% confidence interval.
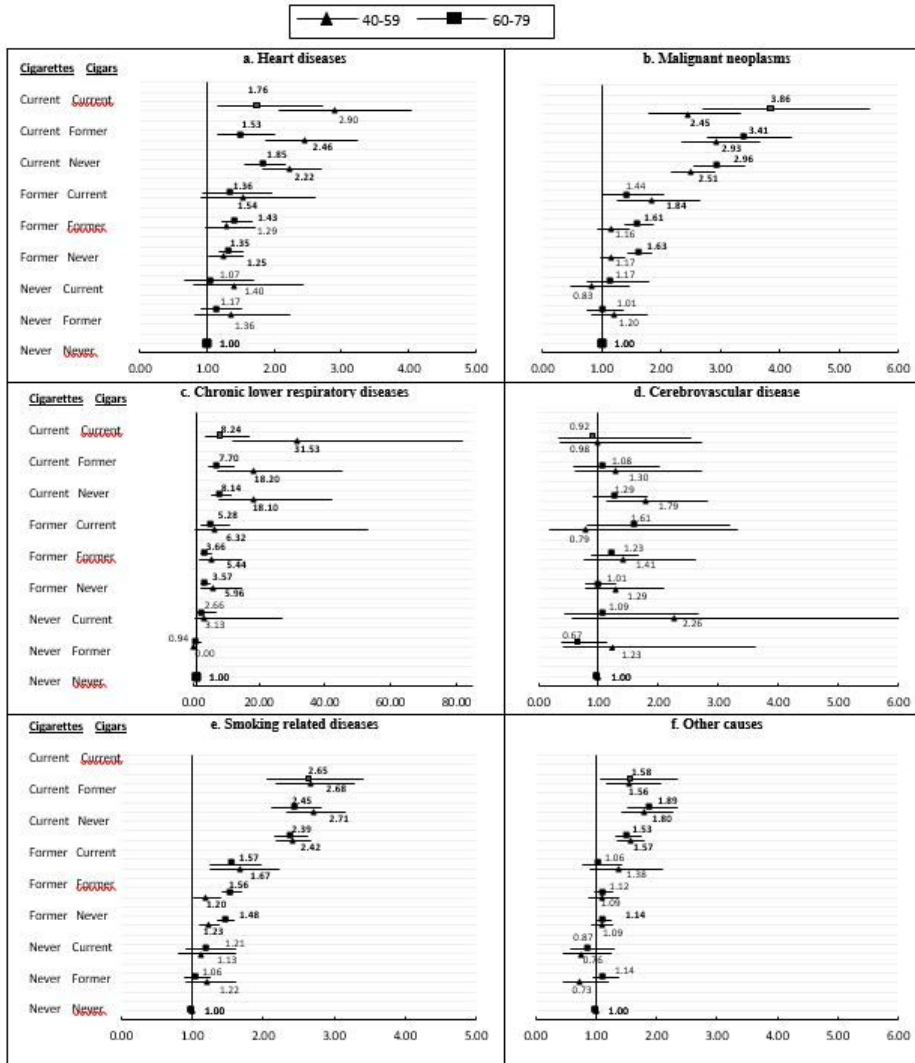
Figure 2

Title: Hazard ratios for specific diseases among men age 40-79 years, according to cigarette and cigar smoking status. Legend: Numbers are the point estimates, bold represents statistically significant. Horizontal lines represent 95% confidence interval. Bold represents statistically significant at the p < 0.05 level. Horizontal lines represent 95% confidence interval.

Supplementary Files

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- SupplementalTable1080620.docx