Patterns of tobacco use among smokers prior to hospitalization for an acute cardiac event: Use of combusted and non-combusted products

Irene Pericot-Valverde[a,b,c,*], Rebecca J. Elliott[a,b], Jeff S. Priest[a,d], Trace Barret[e], Jin H. Yoon[f], Charles C. Miller III[g], Chizimuzo T.C. Okoli[h], Ilana Haliwa[i], Philip A. Ades[e], Diann E. Gaalema[a,b]

[a] Vermont Center on Behavior and Health, University of Vermont, Burlington, VT, United States of America
[b] Departments of Psychiatry, University of Vermont, Burlington, VT, United States of America
[c] School of Health Research, Clemson University, Greenville, SC, United States of America
[d] Biostatistical Unit, University of Vermont, Burlington, VT, United States of America
[e] Division of Cardiology, University of Vermont, Burlington, VT, United States of America
[f] Department of Psychiatry and Behavioral Sciences, University of Texas Health Science at Houston, Houston, TX, United States of America
[g] Department of Cardiothoracic and Vascular Surgery, University of Texas Health Science at Houston, Houston, TX, United States of America
[h] College of Nursing, University of Kentucky, Lexington, KY, United States of America
[i] Department of Behavioral Neuroscience, West Virginia University, Morgantown, WV, United States of America

A R T I C L E   I N F O

A B S T R A C T

Use of tobacco products before or after a cardiac event increases risk of morbidity and mortality. Unlike cigarette smoking, which is generally screened in the healthcare system, identifying the use of other tobacco products remains virtually unexplored. This study aimed at characterizing the use of other non-combusted tobacco products in addition to combusted products among cardiac patients and identifying a profile of patients who are more likely to use non-combusted products. Patients (N = 168) hospitalized for a coronary event who reported being current cigarette smokers completed a survey querying sociodemographics, cardiac diagnoses, use of other tobacco products, and perceptions towards these products. Classification and regression tree (CART) analysis was used to identify which interrelationships of participants characteristics led to profiles of smoking cardiac patients more likely to also be using non-combusted tobacco products. Results showed that non-combusted tobacco product use ranged from 0% to 47% depending on patient characteristic combinations. Younger age and lower perception that cigarette smoking is responsible for their cardiac condition were the strongest predictive factors for use of non-combusted products. Tobacco product use among cardiac patients extends beyond combusted products (13.7% non-combusted product use), and consequently, screening in health care settings should be expanded to encompass other tobacco product use. This study also characterizes patients likely to be using non-combusted products in addition to combusted, a group at high-risk due to their multiple product use, but also a group that may be amenable to harm reduction approaches and evidence-based tobacco treatment strategies.

1. Introduction

Coronary heart disease (CHD) is the leading cause of morbidity and mortality in the US, accounting for > 360,000 deaths annually. The incidence of myocardial infarctions (commonly known as heart attacks) every year is also concerning with an estimated 790,000 occurring, of which over 26% are recurrent (Benjamin et al., 2017). The risk of these events is modifiable and a series of risk factors that can be treated or controlled through behavior change or medication have been identified (Joseph et al., 2017). Tobacco product use, such as cigarette smoking, is

the strongest modifiable risk factor for future morbidity and mortality (Berndt et al., 2012). Prior studies have estimated that cardiac patients who quit smoking after a major cardiac event have up to a 40% lower risk of recurrent events and mortality (Critchley and Capewell, 2003; Twardella et al., 2014) whereas those who continue smoking are at double the risk of following events and death (Shah et al., 2010; He et al., 2014; Kaplan et al., 2005).

Cardiac patients are routinely asked about their smoking habits by their care providers, and those who report smoking typically receive advice or assistance to quit (Keith et al., 2017). However, the screening

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for the use of other tobacco products is less systematic (Keith et al., 2017; Young-Wolf et al., 2017), despite existing evidence that other tobacco products are increasing in use among cardiac patients (Stanton et al., 2016), with an estimated prevalence of 7%, 6%, and 2.6% for cigars, e-cigarettes, and smokeless tobacco (Gaalema et al., 2017), respectively. This is unfortunate as the use of other tobacco products also has negative effects on the cardiovascular system, with combusted tobacco products, such as cigars being the most damaging products (Chang et al., 2015). Non-combusted tobacco product use, such as smokeless tobacco, also poses a greater morbidity risk to cardiac patients (e.g. heart failure hazard ratio of 1.27 for current users compared to non-users (Arefalk et al., 2018; Alzahrani et al., 2018). More controversial, however, is the risk of non-combusted products relative to cigar or cigarette smoking. As such, some studies have reported that non-combusted use likely bears less risk relative to combusted product use (Wennberg et al., 2007; Benowitz and Fraiman, 2017) whereas other studies have not observed reduced levels of cardiovascular harm for using non-combusted tobacco products (Hernandez et al., 2017).

Previous literature suggests that the use of non-combusted tobacco products among cardiac patients frequently co-occurs in combination with cigarette smoking (Rigotti et al., 2018; Gupta et al., 2018). Smokers with CHD may use non-combusted products for positive reasons such as to quit smoking or reduce daily cigarette smoking (Rigotti et al., 2018; Busch et al., 2016; Kalkhoran et al., 2018) but they may also be used due to their lower cost compared to conventional cigarettes (Nyman et al., 2016) or to maintain nicotine intake in areas where smoking is not permitted (Coleman et al., 2017). Regardless of reason, screening of use of multiple products is necessary due to concerns about the potential that this pattern of tobacco use may have more adverse health effects (Alzahrani et al., 2018; National Center for Chronic Disease Prevention, 2014) or undermine efforts to quit smoking (Glantz and Bareham, 2018). To the contrary, the dual use of combusted and non-combusted tobacco products may represent a pathway to cessation or reduction (Villanti et al., 2018).

The emergence of other tobacco products in the market has completely changed the landscape of tobacco product use among cardiac patients. While a few prior studies have explored correlates of other tobacco product use among cardiac patients (Gaalema et al., 2017; Rigotti et al., 2018; Busch et al., 2016) little has been done looking at the profiles of cardiac patients using both combusted and non-combusted products. It should also be noted that these previous studies have used regression models or bivariate analyses to identify independent factors associated with other tobacco product use (Gaalema et al., 2017; Rigotti et al., 2018). Although these statistical methods provide information of relevant profile characteristics, it has limited utility for identifying profiles of cardiac patients using other tobacco products. The Classification and Regression Tree model (CART) is a novel approach that, through a tree diagram, can categorize individuals by combinations of characteristics into groups with more and less likelihood of using non-combusted products, providing more clinically relevant information. Accordingly, the aims of this study were to use CART models (1) to explore rates and risk factors also using non-combusted tobacco product use versus only combusted among current cigarette smokers who recently experienced a cardiac event, and to explore (2) how combinations of these factors are associated with profiles of particularly low- and high-likelihood of use.

2. Methods

2.1. Participants

This study represents a component of a study aimed at investigating patterns of use of tobacco products among hospitalized cardiac patients who would be eligible for outpatient rehabilitation (N = 205). Inclusion criteria were being ≥18 years old, being hospitalized due to a serious cardiac event (myocardial infarction, coronary bypass surgery,

stent placement, heart valve surgery), and having smoked cigarettes or used other nicotine and tobacco products during the 3 months prior to hospital admission. For the purposes of this study the sample was restricted to respondents who were current cigarette smokers at the time of their hospitalization (N = 168).

2.2. Instrument and procedure

Participants were identified from the inpatient clinical databases at three medical institutions: the University of Vermont Medical Center, the University of Texas Health Science Center at Houston, and the University of Kentucky Medical Center. Participants were approached in their hospital rooms and explained the purpose and procedure of the study. Those who agreed to participate and provided written informed consent completed a survey composed of 35 items (see Supplementary Material 1). This survey collected information regarding basic socio-demographics, cardiac diagnoses, history and frequency of use of nicotine replacement products (patch, gum, inhaler, nasal spray, lozenge, and pill) and both non-combusted (e-cigarettes, snuff, dip, chewing tobacco, snus, and hookah/waterpipe) and combusted tobacco products (cigarettes, traditional cigars, little cigars, cigarillos, bidis, and cloves), as well as perceptions and attitudes towards these products. The survey took approximately 15 min to complete. All participants provided written informed consent and procedures were approved by the institutional review board at each study site.

2.3. Measures

The following subset of variables assessed in the survey was examined in this study: Sociodemographic information included age, gender, race/ethnicity, and educational attainment. Physical health-related characteristics included height and weight. Body mass index (BMI) was calculated by dividing weight and height squared [BMI = weight in pounds/(height in inches)^2 × 703]. Mental health-related characteristics included anxiety and depressive symptoms which were assessed using the Generalized Anxiety Disorder scale (GAD-2) (Löwe et al., 2008) and the Patient Health Questionnaire (PHQ-2) (Manea et al., 2015), respectively. The cardiac diagnosis that prompted their hospital admission was also noted. Diagnoses were redefined into two categories: surgical diagnosis (coronary artery bypass grafting or valve repair/replacement) and non-surgical diagnosis (percutaneous coronary intervention, myocardial infarction, and stable angina pectoris).

2.3.1. Cigarette smoking status

Respondents were identified as current smokers if they reported having smoked ≥100 cigarettes lifetime and smoking every day or some days just before hospitalization. Cigarette smokers were also asked number of cigarettes they were smoking per day in the week before their hospitalization and time to the first cigarette in the morning, which combined provided the Heaviness of Smoking Index (Borland et al., 2010).

2.3.2. Other tobacco product use

Participants were defined as current users or non-users of other tobacco products, including e-cigarettes, cigars (traditional cigars, little cigars, or cigarillos), smokeless tobacco (snuff, dip, chewing tobacco), snus, bidis/cloves, hookah/waterpipe. Current users were defined as respondents who reported having used the product ¨every day¨ or ¨some days¨ in the past 30 days. Non-users were defined as those who reported not having used the product. Respondents were identified as users of only combusted (cigarettes, cigars, bidis/cloves, hookah/waterpipe) vs combusted plus non-combusted (e-cigarettes, smokeless tobacco, snus).

2.3.3. Perceived smoking-related harm

Participants were asked to what extent they thought that a) their

overall health has been affected by smoking, b) smoking is responsible for their current condition, c) their illness will worsen if they continue smoking, c) how much quitting smoking could help their health. Response alternatives were: not at all, a little, some, and a lot (Okoli, 2016).

2.3.4. Secondhand tobacco smoke exposure

Respondents were asked about the nature and extent of their exposure to second-hand tobacco smoke from any kind of combusted tobacco product using four items. More specifically, participants were asked whether their partner smokes cigarettes, how many friends and family smoke regularly, and how many people smoke cigarettes inside their home. Respondents were also asked to rate from 0 (not at all) to 10 (extremely) how often they were exposed to second-hand tobacco smoke.

2.4. Data analyses

Frequencies and descriptive statistics were generated for independent variables with the overall sample and separately within groups by type of tobacco products used (i.e., combusted vs combusted and non-combusted). Associations between participants' characteristics and both types of tobacco products used were examined using Student's *t*-test and chi-squared tests. These analyses were conducted using SAS 9.4 Software (SAS Institute, Cary, NC).

CART analyses were conducted to identify characteristic profiles of type of tobacco product used (combusted vs. combusted plus non-combusted). CART analysis is a nonparametric descriptive procedure for classifying members of the population of interest (in this study cardiac patients) into various risk categories as a function of a dependent variable of interest (i.e., type of tobacco products used) and, in the process, identifying which individual variables are most strongly associated with the dependent variable. This method uses binary recursive portioning to split data into mutually exclusive subgroups or risk profiles, resulting in a decision tree. The CART analysis begins by dividing the entire population (i.e., parent node) into two subgroups (i.e., child nodes) as a function of the most discriminating independent variable. Then, these child nodes are recursively portioned into more child nodes using a predetermined criterion until no additional beneficial splits can be made. Gini impurity criterion was used to determine the splits. Based on this criterion, nodes were divided to produce the largest improvement in purity (i.e., homogeneity). The tree was constructed using R's rpart package (R Core Team, 2013; Therneau et al., n.d.).

3. Results

Participants sociodemographic characteristics are displayed in Table 1. The majority of cardiac patients included in this study were male (63.7%), were on average 54.2 years old, and had a high school diploma or lower educational attainment (62.5%). Among the overall sample, 86.3% were users of only combusted tobacco products 76.2% of which only smoked cigarettes (Table 2). Comparing participants' characteristics as a function of type of tobacco products used, we observed that those who were using combusted combined with non-combusted were younger, more likely to have a surgical diagnosis, had higher rates of hookah/waterpipe use, and used a higher number of tobacco products than those using only combusted tobacco products. No statistically significant differences between groups were found for any other variable.

The CART analyses identified age and perception that cigarette smoking is responsible for their cardiac condition as the two strongest risk factors determining type of tobacco products used. Fig. 1 shows the final CART decision tree modeling types of tobacco product used. In the figure, the top-most rectangle (i.e., parent node) represents the entire sample (N = 168). The rates of using combusted only versus combusted and non-combusted combined were 86% and 14%.

Table 1

Sociodemographics and health-related characteristics among smoking cardiac patients overall and across the two categories of tobacco product use: only combusted and combusted and non-combusted (N = 168), United States, 2016.

Measures	Type of product			
	Overall (N = 168)	Combusted (n = 145)	Combusted and non-combusted (n = 23)	*p*
Sociodemographic characteristics				
Age	54.2 ± 12.8	55.4 ± 12.6	46.3 ± 11.0	.00
Gender (% male)	63.7	63.4	65.2	.87
Education (%)				.38
< High school	17.3	15.9	26.1	
High school graduate/GED	45.2	47.6	30.4	
Some college	25.0	24.8	26.1	
≥ University	12.5	11.7	17.4	
Race/ethnicity (%)				.75
White	92.9	93.1	91.3	
Other	7.1	6.9	8.7	
Physical health-related measures				
BMI[a]	29.3 ± 7.4	28.8 ± 7.2	31.5 ± 8.3	.10
Prior cardiac event (%)				.60
Yes	42.9	42.1	47.8	
No	57.1	57.9	52.2	
Primary cardiac diagnosis (%)				
Non-surgical	57.7	61.4	34.8	.02
Surgical	42.3	38.96	65.2	
Mental health-related measures				
GAD-2[a]	2.8 ± 2.1	2.7 ± . 2.1	3.2 ± 1.9	.27
PHQ-2[a]	2.0 ± 2.0	2.0 ± 2.1	2.1 ± 1.9	.90

Note. [a] = Means ± SD; *p* values for *t*-tests and chi-squared tests; GED = General Education Development; BMI = Body Mass Index; GAD-2 = Generalized Anxiety Disorder scale; PHQ-2 = Patient Health Questionnaire.

For type of tobacco products used (Fig. 1), the first split of the sample was based on whether someone was < 50 versus ≥ 50 years. Younger individuals (i.e., < 50 years) branched rightward and downward to a child node representing 34% of the sample where the rate of using combusted combined with non-combusted products was 26%. Older individuals (i.e., ≥ 50 years) branched leftward and downward to a child node representing the 66% of the sample wherein 93% were using only combusted products and only 7% were using combusted and non-combusted tobacco products (Table 3).

The next split for younger individuals (i.e., < 50 years) was based on the extent that patients perceived that smoking was responsible for their cardiac condition. Patients who perceived that smoking was not responsible for their cardiac condition branched rightward and downward to a terminal node where 47% were using non-combusted products whereas those who perceived that smoking was responsible for their condition branched leftward and downward to a child node where 19% were using non-combusted products. For older respondents (i.e., ≥ 50 years) the following branching was based on a BMI cutoff of 31. Those who had a BMI < 31 branched leftward and downward to a child node where use of non-combusted products decreased from 7% to 4% whereas those with a BMI ≥ 31 branched to a child node where use increased from 14% to 16%.

Branching continued until no more classifications were optimal. The final model identified a total of 10 terminal nodes where the use of only combusted tobacco products was the predominant pattern of use of tobacco products as indicated in the bottom row of each terminal node. These terminal nodes representing cardiac patients included rates of non-combusted tobacco product use as low as 0% (the 1st terminal node from the left) and as high as 47% (the 1st terminal node from the

Table 2
Prevalence of current use of nicotine and tobacco products among smoking cardiac patients overall and across the two categories of tobacco product use: only combusted and combusted and non-combusted (N = 168), United States, 2016.

Measures	Type of product			
	Overall (N = 168)	Combusted (n = 145)	Combusted and non-combusted (n = 23)	p
Cigarettes per day[a]	18.7 ± 77.1	18.9 ± 11.4	17.3 ± 9.7	.53
HSI[a]	3.1 ± 1.5	3.1 ± 1.5	2.8 ± 1.6	.38
Number of tobacco products used (%)				.00
Only cigarettes	76.2	88.3	0	
Two products	19.6	11.7	69.6	
Three or more products	4.2	0	30.4	
Cigars				
Every day	3.6	4.1	0	.43
Some days	8.3	7.6	13.0	
Not at all	88.1	88.3	87.0	
Bidis/cloves				–
Every day	0	0	0	
Some days	0	0	0	
Not at all	100	100	100	
Hookah/waterpipe				.01
Every day	0	0	0	
Some days	0.6	0	4.3	
Not at all	99.4	100	99.4	
E-cigarettes				.00
Every day	0.6	0	4.3	
Some days	9.5	0	69.6	
Not at all	89.9	100	26.1	
Smokeless tobacco				
Every day	0.6	0	4.3	.00
Some days	3.6	0	26.1	
Not at all	95.8	100	69.6	
Snus				.00
Every day	0	0	0	
Some days	1.8	0	13.0	
Not at all	98.2	100	87.0	

Note. [a] = Means ± SD; p values for t-tests and chi-squared tests; HSI = Heavy Smoking Index.

right) which is displayed in the second row of each terminal node. More specifically, the risk profile representing individuals aged < 50 years of age who perceive that cigarette smoking is responsible for their condition characterized the profile that represents the greatest likelihood of using non-combusted tobacco products in addition to combusted products (i.e. 47%). The profile with the lowest rate of use of non-combusted products (i.e. 0%) were cardiac patients aged 54 years of age or older, with a BMI < 31, and who had higher levels of dependence (i.e., HSI ≥ 1.5).

4. Discussion and conclusions

The present study focused on use of non-combusted tobacco products in smoking individuals admitted for an acute cardiac event at three large medical centers. We CART modeling to (1) identify characteristics associated with use of combusted products alone versus combusted and non-combusted tobacco products combined and (2) to explore how these characteristics and their interrelationships delineate profiles of cardiac patients that vary in their patterns of tobacco use. The results showed that non-combusted tobacco product use ranged from as low as 0% to as high as 47% depending on patient characteristic combinations. Indeed, age and perceptions about cigarette smoking causing cardiac conditions were the most striking risk factors in determining the type of products used. The results also showed that the dominant pattern of tobacco use in acute-care cardiac patients is to use

cigarettes alone. Finally, the CART analysis conducted characterized the specific profile of cardiac patients most likely to be using combusted and non-combusted products combined.

The two most predictive factors determining whether cardiac patients who smoke were also using non-combusted tobacco products were younger age and lower perception that cigarette smoking is responsible for the cardiac condition. Younger age has been systematically associated with higher probability of using non-combusted tobacco products even among cardiac patients (Gaalema et al., 2017; Rigotti et al., 2018; Busch et al., 2016) a population that is generally older. In this sample, over a quarter of patients under the age of 50 were also using non-combusted products. This finding mirrors what is already found among the general population, that younger individuals are more willing to try other tobacco products, use multiple products, and less likely to commit to the sole use of conventional cigarettes (Wong et al., 2016; Lee et al., 2014). Younger cardiac patients may also underestimate their personal risk of tobacco use, often because they face fewer health-related consequences of smoking or believe that their personal risk is lower than that of older patients because of their shorter period of time smoking (Abed et al., 2015).

Lower perceptions about the health effects of cigarette smoking were also associated with a higher probability of using non-combusted products in addition to combusted. It is well established that smokers tend to perceive that non-combusted tobacco products, such as e-cigarettes and smokeless tobacco, are less harmful than conventional cigarettes (Feirman et al., 2018; Cooper et al., 2017). So, it would be possible that individuals with lower harm perceptions about cigarette smoking would have lower harm perception of non-combusted tobacco products (Cooper et al., 2016), and consequently, they may be more likely to initiate use of these products. The finding that the combination of these two factors (i.e., younger age and lower perceived harm of cigarette smoking) led to a profile of patients who smoke that are at a higher risk for using non-combusted tobacco products should also be highlighted. This profile might represent that these cardiac patients are still part of the workplace population and may be using non-combusted products to maintain levels of nicotine in workplaces with smoking restrictions (National Center for Chronic Disease Prevention, 2014). As non-combusted products do not smell, they are a discreet way to use tobacco in the workplace without anyone noticing. Additionally, for employers, non-combusted tobacco products could be seen as a way to reduce break time as their use may not require as many breaks as using combusted tobacco products.

The use of combining combusted and non-combusted use in this population has several clinical implications. First, there is the concern of the potential negative effects of this pattern of usage. Given the devastating effects that continued smoking has on cardiac patients' health, the uptake of non-combusted tobacco products among cardiac patients may represent a major public health problem if the use of these products proves to reduce smoking cessation rates, intentions to cease, or attempts to quit (Rigotti et al., 2018). Another issue that arises is the possibility that by supplementing their nicotine intake from cigarettes with non-combusted products these individuals may actually increase the overall nicotine consumption (Dunbar et al., 2016). Along with potential cardiac health effects of additional nicotine exposure intake in this population, it could also increase their nicotine dependence levels, potentially resulting in a greater difficulty to quit smoking (Vogiatzis et al., 2017).

With all patients using tobacco, the first approach should be to provide current evidence-based tobacco cessation treatments. Extensive evidence has demonstrated the efficacy of both behavioral and pharmacologic aids to tobacco use cessation among cardiac patients (Prochaska and Benowitz, 2015). The gold standard for treating tobacco dependence in the US is providing patients with Food and Drug Administration (FDA) approved first line treatment options such as nicotine replacement therapy, varenicline, and bupropion (Suissa et al., 2017). In combination with several psychosocial interventions, there is
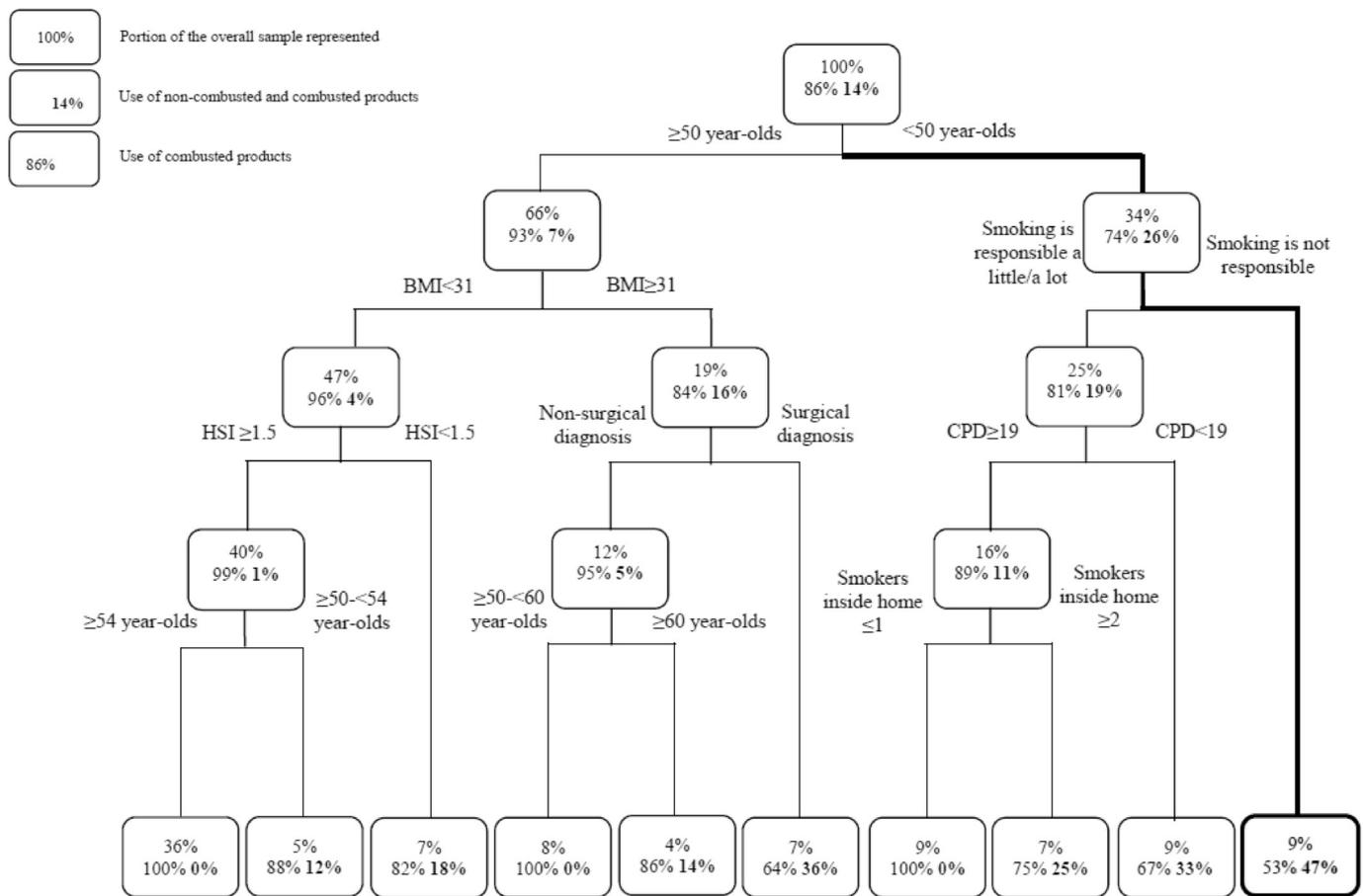
Fig. 1. Classification and regression tree (CART) model of associations between use of non-combusted tobacco products in addition to combusted products and the following risk factors in this sample of cardiac patients: age, gender, educational attainment, race/ethnicity, body mass index, number of cigarettes smoked per day prior to hospitalization, level of nicotine dependence, anxiety and depressive symptoms, perceived smoking-related harm, and secondhand tobacco smoke exposure. Squares (nodes) represent percentages of use of combusted plus non-combusted (in bold) vs only combusted for the entire sample (top-most node) or population subgroups (all other nodes). Nodes also list the percentage of the sample represented. Using the parent node (top-most node) as an example, 14% of the sample were users of non-combusted tobacco products in addition to combusted products and 86% were users of only combusted tobacco products, and this node represent 100% of the sample of cardiac patients. The bottom row comprises terminal nodes (i.e., final partitioning for a particular subgroup).

substantial evidence these approaches assist cardiac patients in their smoking cessation attempts (Barth et al., 2015).

However, as noted in prior literature, achieving complete tobacco abstinence may not be possible in certain populations of cardiac patients who smoke, especially those who are either not interested or unable to quit smoking (Lindson-Hawley et al., 2016). In this context, the finding that certain cardiac patients are using non-combusted tobacco products can also be viewed as an opportunity to implement alternative strategies to reduce the burden of cigarette smoking in a highly dependent population at high risk of future morbidity and mortality. One approach could be recommending cardiac patients temporarily use other non-combusted tobacco products as an aid to quit cigarette smoking. In this regard, prior studies have shown that the use of non-combusted tobacco products among smokers is associated with increased intention to quit cigarette smoking (Tomar et al., 2010; Kalkhoran et al., 2015) and successful quit attempts (Ramström et al., 2016; Zhu et al., 2017; Lund and Lund, 2014). Among cardiac patients there is also recent evidence demonstrating that smokers are using e-cigarettes to quit smoking or reduce their cigarette consumption (Rigotti et al., 2018; Busch et al., 2016). However, it is worth mentioning that the current available evidence is inconclusive regarding the utility of non-combusted products for cigarette cessation or as a harm reduction aid (Villanti et al., 2018). Clearly, further research is needed to determine whether the use of non-combusted products helps or undermines successful cessation.

A second approach would involve encouraging cigarette smokers who already use non-combusted products to entirely replace combusted products with the use of non-combusted nicotine products. Within cardiac patients, compared to the harm of continued smoking even a few cigarettes a day (Hackshaw et al., 2018), switching completely to non-combusted products has the potential to produce a significant public health benefit (Benowitz and Fraiman, 2017) However, it is reasonable to be cautious about recommending the use of non-combusted tobacco products as currently available data cannot definitively address the question of whether or not non-combusted tobacco products have long-term cardiovascular effects. Also concerning is that the current host of non-combusted tobacco products is not regulated as cessation products and consequently, their use should not be at the risk of preventing patients from using known and effective treatment options.

The present study has several limitations that should be mentioned. First, the majority of the respondents were white, which limits the generalization of these findings to ethnic minorities. Second, use of tobacco products was self-reported and not biochemically verified which could have caused participants to underreport their actual use of tobacco products. Third, the sample size of this study is relatively small due to a large number of participants that despite being eligible, were not in a condition to complete the survey due to their critical health situation. Last, this study was conducted exclusively among cigarette smokers of a sample of cardiac patients and thus whether these results

Table 3

Perceptions towards tobacco products and second-hand tobacco smoke exposure among smoking cardiac patients overall and across the two categories of tobacco product use: only combusted and combusted and non-combusted (N = 168), United States, 2016.

Measures	Type of product			
	Overall (N = 168)	Combusted (n = 145)	Combusted and non-combusted (n = 23)	p
Perceived smoking-related harm				
Health affected by smoking (%)				.18
Not at all/a little	21.4	23.4	8.7	
Some/a lot	78.6	76.6	91.3	
Smoking is responsible of their condition (%)				.76
Not at all/a little	25.7	25.0	30.4	
Some/a lot	74.3	75.0	69.6	
Likelihood illness worsening if continue smoking (%)				.51
Not at all/a little	15.7	14.6	22.7	
Some/a lot	84.3	85.4	77.3	
Quitting could help health (%)				.33
Not at all/a little	13.9	12.5	22.7	
Some/a lot	86.1	87.5	77.3	
Second-hand smoke exposure				
Friends smoke (%)				.71
Yes	94.0	93.7	95.7	
No	6.0	6.3	4.3	
Partner smokes (%)				.88
Yes	65.0	65.7	60.0	
No	35.0	34.3	40.0	
Number of smokers inside home (%)				.39
0	41.5	43.1	31.8	
1	21.4	19.7	31.8	
2 or more	37.1	37.2	36.4	
Overall exposure (0 to 10) [a]	4.9 ± 3.4	4.9 ± 3.4	4.9 ± 3.2	.97

Note. [a] = Means ± SD; p values for t-tests and chi-squared tests.

can be generalized to other populations of cardiac patients using solely non-combusted tobacco products should be explored in future studies. These limitations notwithstanding, the present study provides important information about which cardiac patients may be using non-combusted tobacco products in addition to their combusted use, namely young and/or with low perceptions about the harmful effects of cigarette smoking. Until all uncertainties about the potential harms of combining combusted and non-combusted products are clarified, such patients should be counseled about the risks of continued use of multiple products and be encouraged to abstain, to potentially shift their use to non-combusted only, or to consider current evidence-based cessation approaches.

Declaration of Competing Interest

The authors report no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ypmed.2019.105757.

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