Relationship between tobacco use and health-related quality of life (HRQoL) among clients in substance use disorders treatment

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Abstract

We examined relationships of smoking status and tobacco-related variables with health-related quality of life (HRQoL), a metric of disease burden, among clients in substance use disorders (SUDs) treatment. Participants (N = 2,068; 46.6% female) completed surveys reporting demographics, smoking status, and past month days they experienced physical and/or mental health distress. Smokers (n = 1,596; 77.2% of sample) answered questions on tobacco-related variables. Multinomial regression models assessed relationships between tobacco-related variables (smoking status, nicotine dependence, menthol smoking, electronic-cigarette use, health concerns and cost as reasons affecting reducing/quitting smoking, past and future quit attempts) with HRQol in 4 categories (good health, physical health distress, mental health distress, or both physical and mental health distress). Current smokers were more likely than former smokers to report frequent physical and mental health distress than good health (OR = 1.97, 95% CI= 1.16, 3.34), as were smokers with higher nicotine dependence (OR=1.18, 95%CI=1.03, 1.35). Smokers reporting both frequent physical and mental health distress were more sensitive to cigarettes' cost (OR=1.56, 95%CI= 1.06, 2.29), and less likely to use e-cigarettes (OR=0.59, 95%CI= 0.38, 0.94). Findings of poor HRQoL among nicotine dependent smokers with additional SUDs strengthen the imperative to provide smoking cessation interventions in addictions treatment.

Keywords

Health-related quality of life; substance use disorders treatment; smoking; tobacco; nicotine dependence

Introduction

Health-related quality of life (HRQoL), a subjective assessment of physical and mental well-being in daily life, has emerged as a measure of the burden of disease and as a patient-centered outcome (Centers for Disease Control and Prevention [CDC], 2000). In substance

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Disclosure Statement: The authors declare that they have no conflicts of interest.

use disorder (SUD) research, HRQoL has been proposed as a measure of the negative impacts of substance use across life domains, as a way to identify subjective experience important to clients, and as an assessment of recovery beyond substance use outcomes (Laudet 2011).

Both physical and mental HRQoL have been found to be lower among SUD clients than normative averages (Oppezzo et al. 2016, Levola et al. 2014, Korthuis et al. 2011, Prochaska et al. 2005, Stallvik and Clausen 2017). Greater addiction and withdrawal symptom severity have been associated with lower HRQoL among opioid-dependent patients (Heslin et al. 2011). Lower physical and psychosocial HRQoL have been associated with more severe alcohol, cannabis and cocaine dependence (Lozano, Rojas, and Fernández Calderón 2016). Low HRQoL at SUD treatment entry predicted treatment drop-out at 3 months (Stallvik and Clausen 2017). Conversely, decreases in substance use during and after treatment have been associated with improvements in HRQoL. For example, clients in treatment for opioid use disorders have shown HRQoL improvement, although this may level off over time in treatment (Karow et al. 2011, Krebs et al. 2016, Nosyk et al. 2015). Abstinence at 6 months post-inpatient detoxification has been associated with improved quality of life in the physical, mental and relationship domains, and successful recovery has been shown to be predictive of improved HRQoL in the subsequent year (Vederhus, Birkeland, and Clausen 2016, Garner et al. 2014).

Cigarette smoking is a common comorbid condition among those with SUDs, with reported rates up to 84% among clients in SUD treatment (Guydish, Passalacqua, et al. 2016). A body of literature has shown the burden of smoking on HRQoL to be high. Within the general population, current smokers report lower HRQoL than former smokers, who report lower HRQoL than never smokers (Goldenberg, Danovitch, and IsHak 2014, Piper et al. 2012, Guiterrez-Bedmar et al. 2009, Strine et al. 2005). Additionally, smokers with higher levels of nicotine dependence report lower HRQoL than those with lower levels of nicotine dependence (Goldenberg, Danovitch, and IsHak 2014, Davila et al. 2011, Becoña et al. 2013) and those with unsuccessful quit attempts report lower HRQoL than those with no quit attempts (McClave et al. 2009). Prospective studies have shown that smoking cessation leads to higher HRQoL and lower mortality than continued smoking (Piper et al. 2012, Holahan et al. 2013, Chen et al. 2015, Guiterrez-Bedmar et al. 2009, Tian et al. 2016), and that HRQoL improves with length of abstinence from smoking (Hays et al. 2012, Sarna et al. 2008, Shields, Garner, and Wilkins 2013).

Given evidence that both cigarette smoking and other SUDs are independently associated with lower HRQoL, it is important to identify the impact of cigarette smoking on HRQoL among individuals with SUD disorders. To date, there has been limited research in this area. Smoking, opioid use, and depression were individually associated with lower HRQoL compared to the absence of these conditions, with greater severity associated with the combination of 2 or 3 of these problems (Prochaska et al. 2005). Concurrent smoking among heroin users predicted poor health over 2 years, although other substance use did not, suggesting that concurrent smoking had a worse effect on HRQoL than did other substance use (Williamson et al. 2009). In a SUD treatment sample, smokers of menthol cigarettes were more likely to report being in excellent or very good health and reported fewer days of

mental health distress than non-menthol smokers (Gubner et al. 2018), despite evidence that menthol cigarettes are as harmful as non-menthol (Hoffman 2011). Menthol smokers in Gubner et al. (2018) also reported smoking fewer cigarettes per day, a result consistent with previous studies (Blot et al. 2011, Stahre et al. 2010, Fagan et al. 2010), which may explain the HRQoL finding.

The SUD treatment field has recognized the importance of treating smoking among clients in SUD treatment (Ziedonis et al. 2006, Richter and Arnsten 2006, Baca and Yahne 2009). Although adoption has been gradual, approximately 30–40% of treatment programs reported the provision of smoking cessation counseling services by 2015 (Knudsen 2017). Information regarding HRQoL among SUD treatment clients who smoke may inform smoking cessation interventions. For example, it is possible that low HRQoL (i.e., high physical and mental health distress) acts as a barrier to cessation, given smokers' reports that smoking helps manage distress and their beliefs that quitting may exacerbate symptoms (Twyman et al. 2014). Conversely, improving HRQoL may be a client-centered goal that can be used to motivate smoking cessation efforts. Finally, improved HRQoL after quitting smoking may facilitate positive outcomes for other substances. Obtaining information about HRQoL among those with comorbid smoking and other SUDs is an important preliminary step. The objectives of our study were to (a) evaluate the relationship of smoking status with 4 categories of physical and mental HRQoL in a large sample of clients in SUD treatment and (b) analyze whether specific tobacco-related variables were significant predictors of HRQoL among current smokers in our sample.

Methods

Program Selection

Our study was conducted in 24 SUD treatment programs (10 residential, 7 outpatient, 7 methadone maintenance) affiliated with the National Drug Abuse Treatment Clinical Trials Network (CTN), a national network of research centers and affiliated treatment programs conducting community-based research to improve patient outcomes. Participating programs were randomly selected, stratified by program type (residential, outpatient, methadone maintenance), from among 48 possible programs meeting inclusion criteria (i.e., publicly-funded, at least 60 active patients and willing to assign a staff study-liaison). Participating programs received a $2,000 incentive following the survey site visit. Details of sampling design, program recruitment, and client recruitment are reported in Guydish et al. (Guydish, Tajima, et al. 2016).

Participants and Procedures

Data were drawn from a survey regarding tobacco use and attitudes collected during two annual site visits conducted during 2015 and 2016 at each participating program. All patients who had been enrolled in treatment for at least 10 days and were present in the program at the time of the site visit were eligible to participate. In 2016, we asked participants whether they had previously taken the survey (no, yes, unsure). The number of participants recruited from each program per site visit ranged from 31–55, with a median of 50. Participants provided informed consent, then completed surveys on iPads linked to a

secure server. Each received a $20.00 gift card following survey completion. All study procedures were approved by the University of California, San Francisco Institutional Review Board.

Measures

Demographic characteristics and treatment program—Demographic questions assessed age, gender, race/ethnicity, education, and marital status. Participants were asked to identify the primary substance for which they had entered treatment. Treatment program type was categorized as residential, outpatient or methadone maintenance.

Health-related quality of life (HRQoL)—The outcome variable for HRQoL was based on participants' responses to two of the Healthy Days questions from the CDC Healthy Days Core Module (CDC HRQOL-4) (CDC, 2000). The CDC HRQOL-4 has demonstrated reliability and validity (Moriarty, Zack, and Kobau 2003) and has been rated favorably as a measure of HRQoL (Hagerty et al. 2001). We used two questions from the HRQOL-4 to minimize the time burden for participants who were completing a longer, tobacco use survey: 1) "Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?" and 2) "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?" We defined four possible health-related outcomes. First, responses to the questions were dichotomized to indicate frequent (14 days) or infrequent (< 14 days) health problems, a method used in previous studies employing Healthy Days measures (McClave et al. 2009, Strine et al. 2005). Second, we defined four categories to comprise our 4-level outcome measure: a) good health - reporting infrequent physical and mental health problems; b) physical health distress - reporting frequent physical health problems but infrequent mental health problems; c) mental health distress - reporting frequent mental health problems but infrequent physical health problems; and d) physical and mental health distress - reporting frequent physical and mental health problems. Given that each kind of subjective distress may be differentially associated with smoking, we developed this 4-level outcome measure to independently examine the associations between physical health distress and mental health distress on tobacco-related variables, as well as the effect when both were reported.

Tobacco/nicotine use—All participants reported lifetime smoking and current smoking status. Lifetime smoking included whether they had smoked more than 100 cigarettes in their lifetime. Smoking status was reported as current ("Yes, I currently smoke"), former ("No, I quit smoking"), or never ("No, I have never smoked"). Current smoking was defined as reporting current use and lifetime smoking of >100 cigarettes. Analyses of tobacco-related variables used survey data from current smokers. They reported cigarettes per day and time to first cigarette after awakening, two items used to calculate the Heaviness of Smoking Index (HSI) (Heatherton et al. 1989). HSI is a reliable and valid measure of nicotine dependence (Diaz et al. 2005, John et al. 2004, Borland et al. 2010) shown to be associated with HRQoL in the general population (Becoña et al. 2013). Smokers were asked to report their usual cigarette as menthol or non-menthol. They also provided information

about other tobacco-related variables previously shown to be associated with quit behavior (Savoy et al. 2014, Farsalinos and Polosa 2014, Hill et al. 2014, Campbell et al. 2017). These included e-cigarette/vape pen use in the past 30 days (yes/no), and how much health concerns, and cost of a pack of cigarette may have affected reducing or quitting smoking ("Not at all," "A little," "Somewhat," "A lot"; dichotomized for analyses to "not at all/a little" and "somewhat/a lot"). Lastly, smokers reported if they had made a quit attempt lasting at least 24 hours within the past year, (yes/no) and whether they were seriously thinking of quitting smoking in the next 30 days (yes/no).

Analyses

Demographic characteristics (age, gender, race/ethnicity, education, and marital status), smoking status, primary substance and program type were compared across the 4 HRQoL categories (good health, physical health distress, mental health distress, both physical and mental health distress) using analysis of variance (ANOVA) for continuous variables and chi-square test/Fisher exact test for categorical variables. Variables significant at the .10 alpha level were included in multivariate analyses as control variables.

Association between smoking status and HRQoL—A multinomial logistic regression model was applied to assess associations among smoking status (never smoker, former smoker, current smoker) and HRQoL categories, in which physical health distress, mental health distress, and both physical and mental health distress were compared to good health used as the reference category. To conduct comparisons between all smoking groups, the model was run twice, first with never smokers as a reference category and then with former smokers as a reference category. The model controlled for variables found to be statistically significant at a 0.10 alpha level in univariate analyses; these were age, gender, race/ethnicity, education, marital status and treatment program type. Because the data were collected from 24 clinics, the model also accounted for nesting of participants within clinic using generalized linear mixed models for correlated data.

Associations of tobacco-related variables and HRQoL among smokers—We first performed univariate analyses of tobacco-related variables with HRQoL, our 4-category outcome measure, using analysis of variance (ANOVA) for continuous variables and chi-square test/ Fisher exact tests for categorical variables. Independent variables analyzed were HSI, any past year quit attempt, thinking of quitting in the next 30 days, health concerns affecting reducing/quitting smoking, cost of a pack affecting reducing/quitting smoking, e-cigarette use, and menthol smoking. Variables that were statistically significant at the 0.10 alpha level in univariate analyses were entered in a multinomial logistic regression model. These were HSI, past year quit attempt, health concerns affecting reducing/quitting smoking, cost of a pack affecting reducing/quitting smoking, e-cigarette use, and menthol smoking. The model also controlled for age, gender, race/ethnicity, education, marital status, treatment program type and accounted for nesting of participants within clinic using generalized linear mixed models. Because the rate of missing data was low (1.5%), the multinomial logistic regression models used complete case analysis. All analyses were conducted using SAS version 9.4.

Results

The total sample size was 2,278 including 1,125 participants in 2015 and 1,153 in 2016. We removed 145 participants from the 2016 sample because they said they took the survey before (n = 108), were unsure (n = 33), or did not respond to this question (n = 4). We also removed 65 cases with incomplete responses to the HRQoL questions. The final sample included 2,068 cases. In multivariate analyses of smoking status and HRQoL, the number of cases included in the analyses was 2,062 out of 2,068 participants (99. 7%) due to some missing values for six cases. Our analyses of tobacco-related variables and HRQoL included 1,572 out of 1,596 current smokers (98.5%) due to some missing values for 24 cases.

As shown in Table 1, 69.5% (n=1,437) of participants reported good health in the past 30 days, 4.4% (n=91) reported frequent physical health distress, 16.6% (n=343) reported frequent mental health distress, and 9.6% (n=197) reported both physical and mental health distress. There were 1,596 (77. 2%) current, 318 (15.4%) former and 154 (7.4%) never smokers. We found significant differences across the 4-categories of HRQoL for smoking status (p = .041), and for all demographic variables (Table 1). HRQoL also differed by program type, but not by primary substance. Participants in good health were youngest among the 4 HRQoL groups, with a mean (SD) age of 37.5 (sd = 11.91). They were more likely to be male than female, non-Hispanic white, never married, have a high school diploma or GED, and be in residential treatment. Those with physical health distress were also more likely to be male, non-Hispanic white, and never married. They were more likely to have more than a high school education and be in methadone maintenance treatment. Among those with mental health distress, women were in the majority (56.3%). This group had a plurality of non-Hispanic whites, who were divorced/separated or widowed, with more than a high school education and were in residential treatment. Within the frequent physical and mental health distress group, men were in the slight majority (50.3%,). Members of this group were more likely to be non-Hispanic white, never married, with more than a high school education, and in residential treatment. Significant demographic variables and program type were included as control variables in the multinomial regression models.

Association between smoking status and HRQoL

Results of the multinomial logistic regression model assessing associations between smoking status and HRQoL are summarized in Table 2. The model adjusted for demographics (age, gender, race/ethnicity, marital status, and education), treatment program type, and controlled for the nesting of participants within clinics. Smokers were nearly two times more likely to report physical and mental health distress (versus good health) than former smokers (OR = 1.97, 95% CI= 1.16, 3.34, p=0.012). There were no differences in HRQol between never smokers and former smokers, or never smokers and smokers.

Associations of tobacco-related variables with HRQoL among smokers

Table 3 presents results of univariate analyses examining associations of HRQoL (outcome variable) and selected tobacco-related variables. All variables were significant at p 0.10, except for thinking of quitting in the next 30 days. The significant variables (HSI, any past year quit attempt, health concerns affecting reducing/quitting smoking, cost of a pack

affecting reducing/quitting smoking, e-cigarette use, menthol smoking) were entered into the multinomial logistic regression model.

Results of multinomial logistic regression model of variables associated with HRQoL are summarized in Table 4. The model adjusted for age, gender, race/ethnicity, marital status, education, and treatment program type, and controlled for the nesting of participants within clinics. There were no significant associations between tobacco-related variables and physical health distress (versus good health) or mental health distress (versus good health). In the analysis examining associations between both physical and mental health distress versus good health, smokers with higher HSI were more likely to report physical and mental health distress (OR=1.18, 95%CI=1.03, 1.35, p=0.018). Smokers who reported cost of a pack of cigarettes affected their choice of smoking/quitting "a lot" were 1.56 times more likely to report physical and mental health distress than good health compared to those reporting cost of a pack of cigarettes did not affect smoking/quitting (95% CI= 1.06, 2.29, p=0.023). Smokers who reported e-cigarette use in the past 30 days were 59% less likely to report both physical and mental health distress than good health (95%CI= 0.38, 0.94, p=0.025). There were no significant associations of any past year quit attempts, health concerns affecting smoking/quitting or menthol smoking with HRQoL.

Discussion

In our sample of 2,068 clients in SUD treatment, most (77.2%) were current smokers, while 15.4% were former smokers and 7.4% reported never smoking. Current smokers were significantly more likely than former smokers to report frequent days of both mental and physical health distress relative to good health, a result consistent with findings within the general population (Goldenberg, Danovitch, and IsHak 2014) and among smokers with additional SUDs (Prochaska et al. 2005, Williamson et al. 2009). This finding strengthens evidence that the co-occurrence of cigarette smoking with other SUDs is associated with lower HRQoL than having a SUD or SUDs, but not smoking.

Current smoking was associated with physical and mental health distress combined but was not associated with physical health distress or mental health distress individually. It is possible that the combined variable was a more sensitive measure of overall subjective distress in our sample. It is also possible that the low number of participants with physical health distress only (n= 91) obscured our ability to observe relationships related to this variable. However, we also not observe significant relationships related to mental health distress only despite a larger sample (n=343). These relationships may not occur or not be strong, even when analyzed in larger samples. The lack of HRQoL differences in comparisons involving never smokers may also be related to sample size; low numbers of never smoker participants, (n = 154) may have limited the power of our analysis. Alternatively, it is possible that low HRQoL associated with other SUDs in this population overrides the HRQoL benefits of never smoking.

Our study found that higher nicotine dependence was associated with poor mental and physical HRQoL, a robust finding in prior research across heterogeneous populations (Goldenberg, Danovitch, and IsHak 2014, Kristina et al. 2015, Davila et al. 2011, Becoña et

al. 2013). This result, identifying a group of nicotine-addicted, SUD clients with frequent physical and mental health distress, points to the urgency of treating smoking in SUD programs. These clients experience poor subjective well-being which may have a reciprocal relationship with smoking and substance use. That is, low HRQoL may contribute to smoking and other substance use and, in turn, also be an effect of ongoing use. Low HRQoL could be a barrier to treatment progress for both smoking and other substance use that should be clinically evaluated and addressed. If smoking cessation treatment is provided and smoking cessation can be achieved, it may have a positive impact on clients' HRQoL. This, in turn, may mediate improved substance use outcomes. We did not identify any studies which have examined this. However, it has been shown that clients in SUD treatment with the lowest HRQoL were more likely to drop out of treatment (Stallvik and Clausen 2017) and there is a robust literature associating SUD treatment retention with positive substance use outcomes (Zhang, Friedmann, and Gerstein 2003, Hser et al. 2004, Hubbard, Craddock, and Anderson 2003). Additionally, reviews indicate that quitting smoking during SUD treatment is often associated with neutral or better outcomes for other substance use (Thurgood et al. 2016, McKelvey, Thrul, and Ramo 2017). Prospective studies of smoking cessation interventions in SUD treatment should examine the relationship of HRQoL with treatment retention and with smoking cessation attempts. This research should also evaluate the effect of smoking cessation on HRQoL, and the potential mediation of HRQoL changes due to cessation with other substance use outcomes.

Smokers in our sample reporting e-cigarette/vape pen use were less likely to report physical and mental health distress. We identified one study examining HRQoL among e-cigarette users in the general population. In contrast to our result, it found that e-cigarette use was associated with higher levels of psychological distress than non-use (Park et al. 2017). Nevertheless, our results may indicate use of e-cigarettes among smokers with SUDs as a harm-reduction strategy that improves subjective health. Harm reduction from smoking has been an often cited reason for using e-cigarettes (Farsalinos et al. 2014) corresponding with evidence that it is a less harmful alternative to smoking combustible tobacco (Farsalinos and Polosa 2014).

Current findings may inform tobacco control interventions for this population. Smokers with frequent mental and physical distress were more likely to report cost of a pack of cigarettes as a reason to reduce smoking or to quit than smokers reporting good health. Citing costs as a reason to quit may be associated with lower socio-economic status (SES), a variable we did not assess in our study. In a review of tobacco control interventions, Hill et al. (Hill et al. 2014) found that price increases in tobacco products have the greatest impact on lower SES individuals for reducing tobacco use compared with other strategies. Tobacco price increases, including increases in taxation, may be particularly effective for smokers with additional SUDs and low HRQoL.

Limitations

Our study's examination of the relationship of dual smoking and other substance use with HRQoL contributes to quality of life research in the SUD treatment population. However, several limitations should be noted. Our study is cross-sectional, so we cannot infer causal

relationships among tobacco-related variables and HRQoL. Our measure of HRQoL (i.e., 2 items from the CDC HRQoL-4 used to categorize frequent vs. infrequent days of distress) has been used by other smoking-related, HRQoL studies (McClave et al. 2009, Strine et al. 2005). However, interpretation of results is limited by the measure's unidimensional focus on self-reported days of health distress. Additionally, given the wide range of models and measures used in HRQoL research, cross-study comparisons are also limited (Bakas et al. 2012). Low numbers of never-smokers and low numbers of individuals with only physical distress may have limited power in some analyses. We did not examine several variables that may have had an impact on HRQoL including severity of SUD (Lozano, Rojas, and Fernández Calderón 2016, Heslin et al. 2011), and SES (Hill et al. 2014). We also did not have information regarding physical or mental health diagnoses among participants, which could have provided data regarding the burden of identified, often co-occurring, disorders (i.e., smoking, SUDs, physical and mental health disorders) on quality of life (Hall and Prochaska 2009, Conway et al. 2017). Generalizability of findings across the SUD treatment population may be limited. We randomly selected from among CTN-affiliated treatment programs which have been shown to differ in some respects from non-CTN programs, (Ducharme et al. 2007). For example, publicly-funded CTN programs, as were used in our study, have more unemployed clients on Medicaid than non-CTN programs (Ducharme and Roman 2009). Additionally, participants in our study self-selected for survey completion and may not have been a representative sample. Finally, our SUD treatment sample may differ from the large numbers of individuals with SUDs who never enter treatment (Lipari, Park-Lee, and Van Horn 2016).

Conclusions

This study is among the first to report associations of tobacco-related variables with physical and mental HRQoL among individuals in SUD treatment. Current smokers in SUD treatment reported lower physical and mental HRQoL than former smokers. Additionally, smokers with the lowest HRQoL had the highest level of nicotine dependence. This group of vulnerable clients with dual addictions and high mental and physical health distress may also have higher price sensitivity to the cost of cigarettes, and were less likely to use e-cigarettes. High levels of physical and mental health distress among smokers in our sample emphasize both the importance of and the challenges to treating smoking in SUD treatment. Smoking cessation should be a standard SUD treatment intervention. Furthermore, treating dually-addicted clients who experience physical and mental health distress may be facilitated by evaluating and monitoring HRQoL through the course of treatment.

Acknowledgements:

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Table 1.

Demographics, Smoking Status, Primary Substance, and Treatment Program among Clients in Substance Use Disorders Treatment (N=2,068)

| | Mean (SD) or n (%) | | | | χ^2/F | p[1] value |
	Good health (n=1,437)	Physical health distress (n=91)	Mental health distress (n=343)	Physical and mental health distress (n=197)		
Age	37.5 (11.91)	42.8 (13.07)	38.1 (10.85)	42.4 (12.10)	14.3	**<0.001**
Gender					20.0	**0.002**
Male	795 (55.4%)	47 (51.7%)	148 (43.2%)	99 (50.3%)		
Female	632 (44.0%)	44 (48.4%)	193 (56.3%)	95 (48.2%)		
Other	9 (0.6%)	0	2 (0.6%)	3 (1.5%)		
Race/ethnicity					32.3	**<0.001**
Hispanic	189 (13.2%)	15 (16.5%)	34 (9.9%)	29 (14.7%)		
Non- Hispanic Black	253 (17.6%)	14 (15.4%)	33 (9.6%)	43 (21.8%)		
Non- Hispanic White	796 (55.4%)	52 (57.1%)	236 (68.8%)	94 (47.7%)		
Non- Hispanic Other	199 (13.9%)	10 (11.0%)	40 (11.7%)	31 (15.7%)		
Education					15.4	**0.017**
<HS	296 (20.7%)	23 (25.3%)	62 (18.1%)	52 (26.5%)		
HS/GED	536 (37.3%)	31 (34.1%)	113 (32.9%)	52 (26.5%)		
>HS	602 (42.0%)	37 (40.7%)	168 (49.0%)	92 (46.9%)		
Marital status					13.5	**0.036**
Married/ Not married but in a long-term relationship	520 (36.2%)	27 (29.7%)	102 (29.7%)	66 (33.5%)		
Divorced/Separated/Widowed	360 (25.1%)	32 (35.2%)	109 (31.8%)	62 (31.5%)		
Never married	557 (38.8%)	32 (35.2%)	132 (38.5%)	69 (35.0%)		
Primary substance of use					14.6	0.103
Alcohol	302 (21.0%)	18 (19.8%)	81 (23.6%)	37 (18.9%)		
Stimulants	309 (21.5%)	13 (14.3%)	71 (20.7%)	54 (27.6%)		
Opiates	634 (44.1%)	47 (51.7%)	159 (46.4%)	88 (44.9%)		
Other	192 (13.4%)	13 (14.3%)	32 (9.3%)	17 (8.7%)		
Program type					39.9	**<0.001**
Residential	543 (37.8%)	31 (34.1%)	152 (44.3%)	105 (53.3%)		
Outpatient	482 (33.5%)	25 (27.5%)	91 (26.5%)	28 (14.2%)		
Methadone	412 (28.7%)	35 (38.5%)	100 (29.2%)	64 (32.5%)		
Smoking status					13.1	**0.041**
Current smoker (n=1,596)	1,084 (75.4%)	68 (74.7%)	277 (80.8%)	167 (84.8%)		
Former smoker (n=318)	236 (16.4%)	17 (18.7%)	47 (13.7%)	18 (9.1%)		
Never smoker (n=154)	117 (8.1%)	6 (6.6%)	19 (5.5%)	12 (6.1%)		

[1]Variables significant at p 0.10 included in multivariate analyses as control variables.

Table 2.

Multinomial Logistic Regression Model for the Association between Smoking Status and Health-related Quality of Life among Clients in Substance Use Disorders Treatment (N = 2062) [1]

	Physical health distress vs. Good health	Mental health distress vs. Good health	Physical and mental health distress vs. Good health
	OR (95%CI)	OR (95%CI)	OR (95%CI)
Current smoking status			
- Never smoker	1	1	1
- Former smoker	1.48 (0.56, 3.91)	1.26 (0.69, 2.28)	0.75 (0.34, 1.66)
- Smoker	1.33 (0.55, 3.23)	1.55 (0.92, 2.63)	1.49 (0.77, 2.86)
- Former smoker	1	1	1
- Never smoker	0.67 (0.25, 1.77)	0.80 (0.44, 1.45)	1.35 (0.61, 2.98)
- **Smoker**	0.89 (0.50, 1.59)	1.23 (0.86, 1.76)	**1.97 (1.16, 3.34)**[*]

[1] adjusted for demographics (age, gender, race/ethnicity, marital status, and education) and treatment program type; also controlled for nesting of participants within clinics.

[*] $p < .05$.

Table 3.

Association between Tobacco-related Variables and Health-related Quality of Life among Smokers in Substance Use Disorders Treatment (N=1572)

	Mean (SD) or n (%)				χ^2/F	p value[1]
	Good Health (n=1,084)	Physical health distress (n=68)	Mental health distress (n=277)	Physical and mental health distress (n=167)		
Heaviness of Smoking Index (HSI)	2.6 (1.42)	2.4 (1.70)	2.7 (1.43)	2.9 (1.51)	2.4	**0.064**
Past year quit attempt	519 (47.9)	40 (58.8)	114 (41.2)	68 (40.7)	10.4	**0.015**
Thinking of quitting in the next 30 days	281 (25.9%)	22 (32.4%)	68 (24.6%)	39 (23.5%)		0.534
Health concerns affect smoking/ quitting					6.8	**0.078**
Not at all/a little	561 (52.1%)	31 (46.3%)	121 (43.7%)	81 (48.5%)		
Somewhat/a lot	516 (47.9%)	36 (53.7%)	156 (56.3%)	86 (51.5%)		
Cost of a pack of cigarettes affect smoking/quitting					11.6	**0.009**
Not at all/a little	676 (62.8%)	41 (61.2%)	152 (55.1%)	85 (51.2%)		
Somewhat/a lot	401 (37.2%)	26 (38.8%)	124 (44.9%)	81 (48.8%)		
E-cigarette/vape pens use in past 30 days	304 (28.2%)	20 (29.4%)	84 (30.4%)	28 (16.9%)	11.0	**0.012**
Smokes menthol	601 (55.5%)	32 (47.1%)	129 (46.6%)	85 (50.9%)	8.6	**0.036**

[1] Variables significant at p 0.10 included in multinomial logistic regression model shown in Table 4.

Table 4.

Multinomial Logistic Regression Model for the Association between Tobacco-related Variables and Health-related Quality of Life among Smokers in Substance Use Disorders Treatment (N=1572)[1]

	Physical health distress vs. Good health		Mental health distress vs. Good health		Physical and mental health distress vs. Good health	
	OR (95%CI)	p	OR (95%CI)	p	OR (95%CI)	p
HSI	0.95 (0.79, 1.15)	0.598	1.04 (0.94, 1.16)	0.452	1.18 (1.03, 1.35)	**0.018**
Past year quit attempt						
- No	1		1		1	
- Yes	1.44 (0.83, 2.49)	0.197	0.77 (0.57, 1.04)	0.085	0.74 (0.51, 1.07)	0.108
Health concerns affect smoking/quitting						
- Not at all/a little	1		1		1	
- Somewhat/a lot	1.03 (0.59, 1.81)	0.921	1.27 (0.93, 1.73)	0.127	1.03 (0.70, 1.52)	0.897
Cost of a pack of cigarettes affect smoking/quitting						
- Not at all/a little	1		1		1	
- Somewhat/a lot	0.86 (0.49, 1.52)	0.602	1.25 (0.93, 1.69)	0.143	1.56 (1.06, 2.29)	**0.023**
E-cigarettes/vape pens use in past 30 days						
- No	1		1		1	
- Yes	1.29 (0.73, 2.30)	0.380	1.04 (0.76, 1.41)	0.815	0.59 (0.38, 0.94)	**0.025**
Smokes menthol	0.81 (0.46, 1.42)	0.469	0.86 (0.64, 1.15)	0.298	0.87 (0.59, 1.29)	0.498

[1] adjusted for demographics (age, gender, race/ethnicity, marital status, and education) and treatment program type; also controlled for nesting of participants within clinics.