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Original Research Article

Using the theory of planned behavior to understand student intent to use tobacco in California universities

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ABSTRACT

Background: Most tobacco use, including addiction, starts between 18-26 years of age. To prevent this, the University of California (UC) and California State University (CSU) have implemented system-wide tobacco-free policies in recent years. The objective of this study was to investigate the association of the theory of planned behavior (TPB) constructs: attitude, subjective norms (SN), and perceived behavioral control (PBC) with intention to use tobacco among students in tobacco-free universities in California. Additional objectives were to understand whether these primary TPB constructs were influenced by various policy enforcement levels (i.e., communication and signage), and the availability of smoking cessation programs on campus.
Methods: In this cross-sectional study conducted during March-May 2018, a survey was administered among students within select UC and CSU campuses. Students were recruited by cold-calling and emailing faculty to request assistance in disseminating an electronic survey to their students.
Results: There was a total of 167 survey respondents (mean age=18-24 years). Results indicated that attitude (β=0.12, $p<0.025$), SN (β=0.18, $p<0.001$), and PBC (β=0.33, $p<0.001$) were significantly and positively associated with student intention. Results showed no significant differences between different enforcement levels and TPB constructs but did show significant positive differences in student attitude between campuses that offer smoking cessation programs and campuses that do not ($t=2.55$, $f=6.50$, $p<0.001$).
Conclusions: Findings indicate tobacco-free policies positively influence shifts in student attitude and intention to use tobacco on California university campuses. Administrators are encouraged to tailor enforcement messages to increase compliance.

Keywords: Theory of planned behavior, Tobacco control, Tobacco policies, Tobacco-free universities, College students, Policy intervention

INTRODUCTION

The Centers for Disease Control and Prevention (CDC) states that tobacco use leads to health effects that are harmful to nearly every organ of the body.[1] Data show that over 16-million Americans currently live with a disease caused by tobacco use.[1] Specific conditions include cancer, heart disease, and stroke. The California Department of Public Health (CDPH) further states that those exposed to secondhand smoke and aerosol exposure are also at risk.[2] Furthermore, over 50% of adults in California report being frequently exposed to secondhand smoke.[2]

While California's smoking rate is one of the lowest in the United States, California also has the highest number of smokers nation-wide due to its high population, with over four million adults reported having smoked a

cigarette over the last thirty days.[2] According to the CDPH, approximately 15% of California adults are tobacco users. Additionally, current data show that while tobacco use rates have steadily declined during 1996-2017, they have remained at a steady 15-20% among California adults since 2011.[2] This observed plateau suggests that tobacco use rates may rise again in the future likely due to the production of innovative and appealing tobacco products by the tobacco industry, such as electronic cigarettes, which have caught the attention of many current and former cigarette smokers.[2] Research shows that 20% of former smokers who have been successful in the past in quitting tobacco use are now utilizing electronic cigarettes or flavored options. These newer, innovative products are particularly popular among the young adult population.[2]

According to the CDPH, over 98% of current tobacco users start using by the age of 26.[2] This means that most users likely engage in tobacco use in their late high school years or during their undergraduate studies. This further implies that reducing the initiation rate among the young adult population could be a highly effective and efficient method for reducing future long-term tobacco use rates. [2] Furthermore, research suggests that tobacco-control policies can significantly reduce tobacco use and second-hand smoke exposure, ultimately reducing the burden of chronic disease.[3] According to 2019 data, the public support for tobacco control policies in California has increased, with 92% of the California population in support for smoke-free indoor worksites, 70% in support of smoke and vape-free apartment rental units, 63% in support of discontinuing sale of all tobacco products, and 59% in support of discontinuing sale only on flavored tobacco products.[2] Additionally, incorporating smoking cessation programs to aid tobacco users in quitting or reducing their tobacco use may help lower tobacco use rates.[4] In California, doctors have particularly been consistent in advising and referring patients for smoking cessation programs as indicated though actual patient quit attempts have remained stagnant over the years.[2]

In an effort to reduce the tobacco initiation and use rate among the young adult population, two university systems in California have implemented tobacco-free policies system-wide. Effective January 2014, the UC, comprising of 10 campuses, adopted a system-wide tobacco-free policy to improve the health and safety of all students, staff, faculty, patients and visitors to the UC campuses.[5] Effective September 2017, CSU, comprising of 23 campuses, also released an executive order for a system-wide tobacco-free environment to reduce adverse health effects as well as medical and organizational costs related to tobacco use.[6] Both system policies comprehensively ban the use of all tobacco products on their campuses and select universities within both systems offer smoking cessation programs to their students to increase student compliance to these policies.

Using the TPB, the purpose of this study was to determine: (a) how student attitude, SN, and PBC, are associated with student intent to use tobacco on tobacco-free university campuses; (b) how student attitude, SN, PBC, and student intention to use tobacco on university campuses compare between different enforcement types; and (c) to determine how student attitude, SN, PBC, and student intention to use tobacco on university campuses compare between universities that offer smoking cessation programs to accompany campus policies and universities that do not integrate such programs.

METHODS

This study was approved by the institutional review board (IRB). This was a cross-sectional study surveying students within selected tobacco-free universities in California to understand their attitude, SN, PBC, and intention to use tobacco on campus. The survey was constructed following Ajzen's guidelines to assess each of the TPB constructs.[7] The TPB constructs attitude, SN, and PBC, assessed student attitude regarding using tobacco on campus, SN-student interpersonal influences, such as mentors or friends, that may influence their intention to use tobacco on campus (SN), and PBC-intrinsic factors (i.e., self-control), policy enforcement mechanisms and the availability of smoking cessation programs to determine their influence on student intention to use tobacco on campus). The social ecological model's framework and key principles were further considered to assess factors within the TPB's PBC construct, such as the implementation of different levels of enforcement mechanisms and the influence of the availability of smoking cessation programs. See Figure 1 for a diagram of this framework.

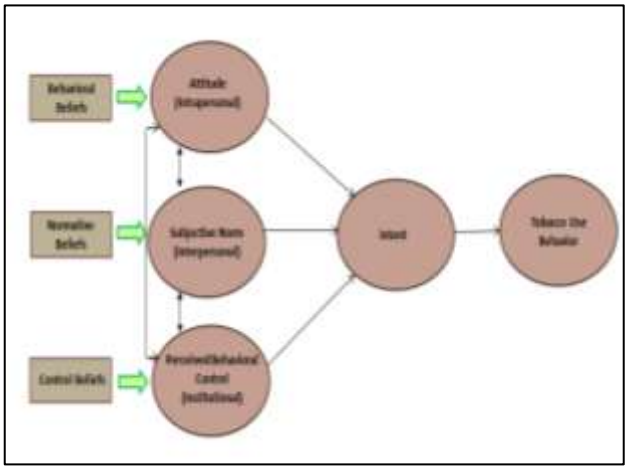

Figure 1: Theoretical framework.

Prior to survey administration, the survey was reviewed for face validity by subject matter experts and shared with three individuals who conducted a "think out loud pre-test", an exercise where each person read the questions out loud and stated the first thing that came to mind so that the researcher could understand whether the

questions made sense.[8] Modifications were made based on the feedback, and then the survey was piloted among seven university students to ensure the questions were understandable. Cronbach's alpha was also calculated to establish internal consistency for each construct. Statements that lowered Cronbach's alpha were discarded. The final Cronbach's alpha values were 0.92 for attitude, 0.93 for SN, 0.73 for PBC, and 0.71 for intention.

The final survey contained 48 total questions, including 15 demographic questions. The remaining questions assessed student attitude, SN, PBC, and intention to use tobacco on campus. The complete survey is available upon request. Survey items for each construct used 5-point Likert-type scale responses, except those for attitude, which relied on a 5-point semantic differential scale. Negatively worded statements that assessed behavioral intention were reverse coded to ensure consistency in the measurement of each TPB construct. The final score for each TPB construct was calculated as the mean of all respective items.

Students were recruited from four universities, two from the university of California system and two from the California State university system. All four universities were selected based on similarities found through analysis of their tobacco-free policies, such as when each policy was adopted, who was affected, and what type of enforcement mechanism was utilized to ensure compliance.

Prior to collecting data, the researcher contacted campus officials from each university to obtain written authorization to collect data on campus. Once authorization was received, the researcher utilized the "directory" function available on each university's webpage to cold call and/or email faculty members to request their assistance with disseminating the electronic survey to their students. Faculty that responded to these calls and/or emails were provided a student consent letter and a Qualtrics-based survey link. The consent letter included detailed information about the study as well as the contact information for the principal investigator. Faculty received instructions on how to forward the consent letter and the survey link to the students in their classes. Faculty members that assisted received incentives, consisting of t shirts and water bottles to distribute among their students.

RESULTS

Student demographics

A total of 167 students from all four campuses responded to the survey (mean age=18-24 years). A majority of respondents (70%) were female. Approximately 57% of all respondents were juniors, forty-one percentages seniors, 2% freshmen and zero percentages sophomores. There was close to equal distribution of the number of students that responded from each selected university. See Table 1 for complete student demographic information (Table 1).

Table 1: Demographics of study participants.

Variables	N	Percentages (%)
Age (Years)		
18-24	138	83
25-34	24	14
35-44	3	2
45or older	2	1
Total	167	100
Gender		
Female	117	70
Male	48	29
Transgender	2	1
Total	167	100
Grade level		
Freshman	4	2
Sophomore	0	0
Junior	95	57
Senior	68	41
Total	167	100
Parents education		
Did not finish high school	38	23
Graduated from high school/GED	53	32
Graduated from 2-year school	31	19
Graduated from 4-year school	13	8
Completed master's degree	15	9
Completed PhD or other advanced degree	17	10
Total	167	100
Student smoking history		
Current tobacco user	153	8
No tobacco use	13	92
Total	167	100

Association of TPB primary constructs with intention to use tobacco on campus

Multiple linear regression was conducted to determine whether there was a statistically significant association between student attitude, SN, PBC, and student intention to use tobacco on campus. On the survey instrument, these constructs were assessed on a scale of 1-5, where higher response numbers were indicative of increased student intention to use tobacco on campus and lower response numbers were indicative of increased intention to refrain from using tobacco on campus.

When testing assumptions, it was found that there were three outliers in the data, which were omitted from the final analysis. Potential confounders (parent educational background, history of nicotine use, and history of drug abuse) were also incorporated into the initial model to determine whether these factors influenced results. This process confirmed that the unstandardized coefficients for the independent variables were not influenced by any of the three potential confounding variables. Therefore, these variables were not included in the final model. All other assumptions, including normality of the dependent variable, linearity, multicollinearity, and Cook's distance were met.

The final model included student attitude, SN, and PBC as independent variables and student intent to use tobacco as the dependent variable. Overall, the final model explained 32% of variance in student intention to use tobacco based on an adjusted R^2 value. The final analysis of results indicated positive, statistically significant associations between the three primary TPB constructs and student intention to use tobacco on campus $F(3,164)=26.840$, $p<0.001$, adjusted $R^2=0.318$. Further analysis showed that individually, student attitude, SN and PBC were significantly and positively associated with student intention to use tobacco on campus. Regression coefficients and standard errors are in Table 2. Results indicate that each unit increase in attitude was associated with a 0.12 increase in intention to use tobacco on campus, with each unit increase in SN there was a 0.18 increase in intention to use tobacco on campus, and with each unit increase in PBC there was a 0.33 increase in intention to use on campus (Table 2).

Table 2: Regression analysis of the association of TPB constructs and student intention to use tobacco on campus.

Variable	β (SE)
Intercept	0.633
Attitude	0.12* (0.06)
SN	0.18** (0.05)
PBC	0.33** (0.06)

*p<0.05, **p<0.001, adjusted $R^2=0.318$.

Comparison of TPB constructs with policy enforcement types

The four campuses selected for this study enforced their policy at different levels. These levels counted as separate categories in this analysis to determine whether specific TPB constructs are significantly influenced by any of these enforcement types, which include (a) communication, (b) communication and signage, and (c) communication, signage and fines. Only one university enforced by communication only, through a health education approach. Two universities utilized both communication and signage to enforce their policy. This means that in addition to health education, those campuses have permanently visible signs posted throughout the campus to enforce the policy. Finally, one university utilizes three enforcement mechanisms: communication, signage and fines. This means that in addition to health education and permanent signage, this campus (solely in their on-campus housing units) fines students for using tobacco.

In this analysis, student attitude, SN, PBC, and intention to use tobacco were compared between universities that implement the three enforcement categories using one-way ANOVA and several Kruskal-Wallis statistical tests. For the intention variable, one-way ANOVA was utilized as there were no outliers, the data were normally distributed (as assessed by boxplot) and there was homogeneity of variances, as assessed by Levene's test ($p=0.08$). For the attitude, SN and PBC constructs, these test assumptions for one-way ANOVA were violated, thus Kruskal-Wallis tests were used to determine whether these constructs were significantly influenced by different levels of enforcement. Results yielded non-significant findings for all constructs, indicating that attitude, SN and PBC were not significantly influenced by different levels of policy enforcement in our study (Tables 3 and 4).

Table 3: Comparison of student intention and levels of policy enforcement using one-way ANOVA.

Variables	Df	F	P value
Intention			
Between	2	2.541	0.82
Within	165		

Comparison of TPB constructs with campuses that offer smoking cessation programs

Two campuses offer free smoking cessation programs to their students through their campus wellness center and two campuses do not offer such programs. In order to determine whether the availability of such resources significantly influences the TPB constructs, independent t-tests were conducted among campuses that offered smoking cessation programs versus campuses that did not.

Findings from these analyses revealed that there was no statistically significant difference between student attitude, SN, PBC, and intention to use tobacco between students attending universities where smoking cessation programs are offered versus students attending universities where such programs are not offered. Student attitude ($p<0.001$) between campuses was significantly associated with the availability of smoking cessation programs (Table 5).

Table 4: Comparison of attitude, SN and PBC with levels of policy enforcement using Kruskal-Wallis.

Constructs enforcement levels		N	Mean rank	Df	X^2	P
Attitude	Communication only	40	72.18	2	5.355	0.07
	Communication and signage	80	90.86			
	Communication, signage and fines	47	82.38			
SN	Communication only	40	77.89	2	1.097	0.58
	Communication and signage	80	84.68			
	Communication, signage and fines	47	88.04			
PBC	Communication only	40	74.69	2	2.392	0.30
	Communication and signage	80	89.09			
	Communication, signage and fines	47	83.26			

Table 5: Comparison of means between TPB constructs and smoking cessation resources using independent t test.

Variables	Smoking cessation program	N	Mean**	Std. deviation	P value
Attitude	Yes	80	1.61	0.834	<0.001*
	No	87	1.33	0.590	
SN	Yes	80	1.57	0.768	0.268
	No	87	1.63	0.912	
PBC	Yes	80	2.39	0.618	0.192
	No	87	2.25	0.718	
Intention	Yes	80	1.97	0.634	0.159
	No	87	1.79	0.525	

*Significant at p<0.05, **Higher mean values are indicative of increased student intention to use tobacco on campus.

DISCUSSION

The results of this study are consistent with existing research on utilizing the TPB in predicting tobacco use behavior. Overall, the multiple linear regression model explained 32% of the variance in behavioral intention, consistent with other studies.[9] In a study conducted by Topa and Moriano, it was found that the strength of the associations between TPB constructs and smoking behavior was largely influenced by the characteristics of study participants.[10] Their specific findings, which were based on secondary data of 19 studies previously conducted in the U.S. and in Europe, indicated that smoking behavior was related to smoking intentions, and that these intentions were related to participant attitudes, SN, and PBC relating to their intention to smoke. [10]

Similar studies yielded a mix of non-significant associations between SN and behavioral intention. In this study, this association yielded significant results. Topa and Moriano suggest that factors which influence this particular association are largely personal factors, instead of social ones.[10] Upon review of participant demographics, this may be because a majority of students that participated in the study are not current (92%) or past (81%) tobacco users. Tobacco use is also typically lower among 4-year college students, as was found in a study conducted by Lenk et al. [11] Further research is recommended to explore this association among a greater percentage of current and past tobacco users as well as those enrolled in different types of colleges.

Topa and Moriano also propose that the association between PBC and intention may not always capture all factors that measure individual control over their behaviors.[10] Due to this, other factors may need to be considered when concluding whether an association exists between the two constructs and the strength of the association. Examples of such factors include external factors, such as campus policies, enforcement and smoking cessation resources, to ensure that these influences were accounted for when assessing this association.[10] Upon doing so, it provided greater understanding of which factors of the tobacco-free policies were significantly associated with student intention to use tobacco on campus. Further, Pearson correlation tests were conducted to determine whether student awareness of policy provisions and smoking cessation resources correlated with PBC and behavioral intention, and Topa and Moriano found that this awareness was significantly and negatively correlated with their PBC (r=-0.55, n=167, p<0.001) and intention (r=-0.34, n=167, p<0.001) variables.[10] This indicates that awareness to the policy does not necessarily mean that desired behavior will be observed among students.

In examining the primary TPB constructs and the different enforcement types, it was found that all TPB constructs were not significantly associated with different levels of enforcement. Macy et al conducted a study in which the TPB was applied to explore the relationship between smoke-free air laws and quitting intentions through which the authors captured data among smokers in Texas, concluding that the smoke-free air laws

influence quitting through formation of positive attitudes and creation of a cultural norm in public so that smokers are able to fight the urge to quit.[14] This is consistent with the findings of this study, since there were positive, significant associations between student attitude and student intention to use tobacco on campus.

Additionally, all universities selected for this study did not impose punitive enforcement for student non-compliance to the policy. Research indicates that fines or penalties for non-compliance to policies are typically effective, as was observed in a study conducted by Leonard et al where it was found that fines on youth smoking significantly decrease tobacco use rates and prevent the onset of addiction at an early age.[13] In this study, only one campus imposed fines on students for non-compliance, however the reason this was not a significant finding in this particular study could be due to the fact that the fines implemented within that campus are only within the student housing area of campus and not the entire campus. This could also be due to the fact that not many students have been seen violating the tobacco-free policy on this campus. Since a majority of survey respondents within this university indicated their grade level as junior or seniors, these are typically the years during college when students move to off-campus housing, which means these students would not be subject to fines for using tobacco on campus. Further research is recommended among campuses that impose punitive enforcement mechanisms to determine whether these significantly influence TPB constructs. Finally, attitude was significantly influenced by the availability of smoking cessation programs. This implies that smoking cessation programs influence student attitude which then was found to be significantly associated with student intention to use tobacco on campus. However, further research is also recommended to understand whether student awareness of the availability of smoking cessation programs is associated with attitude.

In summary, attitude, SN and PBC were found to be significantly associated with student intention to use tobacco on campus. Different levels of enforcement did not yield significant results between campuses among all TPB constructs and attitude was significantly associated by the availability of smoking cessation programs. However, all TPB constructs are useful to predict tobacco use behavior among students.[14] Further research is recommended to understand other factors that may influence these associations, such as punitive enforcement mechanisms, student enrollment at four-year universities versus two-year or student field of study.

Limitations

One limitation of this study is that students provided self-report data which may result in response bias. Although all responses were provided anonymously, there may have been external sources which could have influenced students' responses to survey questions. This can lead to response bias because the student would be submitting answers which he/she may know to be true but doesn't reflect their true opinion or behavior.

Another limitation is related to participant recruitment. The student researcher conducted cold calls and/or emails to university faculty members in various departments and only a select few responded. Those that replied represented a certain department within the university, therefore the participants recruited are only within certain subjects or disciplines. However, these subjects or discipline varied so that both health-related and non-health related subjects were represented. Additionally, there was not enough data to evaluate results between tobacco users and non-tobacco users because over 90% of participants indicated no current tobacco use behaviors, leaving only a small percentage of participants who actually use tobacco on campus. Similarly, most survey respondents were female which could also add additional female bias into the survey results.

Strengths

A strength of this study is the fact that IRB departments of each institution allowed the first author to collect this data. While the IRB restricted the first author from contacting students directly which did not make it possible to capture response rate, this allowed the first author access to campus affiliates that could help provide this useful and informative data.

Another strength of this study is that since the UC and CSU systems have implemented tobacco-free policies within recent years, this is among the first studies conducted to determine whether the policy has influenced student intention to use tobacco on campus. Results from this study will be particularly useful to better understand factors that will ensure that these policies are successful in ensuring smoke and tobacco-free university environments.

Finally, as previously stated, the prevalence of tobacco use has plateaued in recent years and is likely to rise again due to the availability of more innovative tobacco products being produced by the tobacco industry targeted specifically for this young adult population. This study aims to understand the factors that influence student tobacco use on campus so that future efforts can be aimed toward reducing the prevalence of future addiction and disease among this population as a result.

Implications for practice

UC and CSU system administrations may use these findings to inform interventions aimed toward increasing student compliance to their tobacco-free policies. Strategic planning and program development aimed to strengthen the association between student attitude, SN and PBC could be significant in ensuring this compliance. Further research in identifying additional factors that

contribute to the association between PBC and student intention will aid in the program planning and development process. Finally, other colleges and universities considering implementation of a smoke or tobacco-free policy on their campus can apply these findings to move toward a tobacco-free environment.

CONCLUSION

Findings indicate tobacco-free policies positively influence shifts in student attitude and intention to use tobacco on California university campuses. Administrators are encouraged to tailor enforcement messages to increase compliance.

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