ORIGINAL ARTICLE

SMOKING BEHAVIORS AND ATTITUDES TOWARDS THE SMOKE-FREE CAMPUS POLICY: A SYSTEMATIC REVIEW

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ABSTRACT

We conducted this systematic review to document the published literature related to smoking behaviors and attitudes towards the smoke-free campus policy. Studies on universities that had implemented the smoke-free campus policy were included in this review. The search for published articles from January 2010 to December 2020 involved three main electronic databases: Ovid MEDLINE, ScienceDirect, and Scopus. We searched the databases with the following Boolean string: [(smoke-free OR tobacco-free) AND (campus OR university OR college) AND (knowledge OR attitude* OR practice*)]. Seventeen studies were included in this review. The majority (n = 8) were from the United States, followed by Saudi Arabia (n = 2) and one each from Israel, Lebanon, Australia, Canada, the United Kingdom, Spain, and China. Eight studies reported a positive impact of the policy on smoking behavior (plan to quit smoking, attempt to quit smoking, reduce smoking). However, 11 studies reported that respondents were still exposed to second-hand smoke and that cigarette butts were still scattered around the university area. Nine studies reported negative attitudes towards smoking, and seven of 12 studies reported positive attitudes towards the policy. Overall, the smoke-free campus policy had mixed impacts. Nevertheless, we found that attitude towards a smoke-free campus and smoking behavior has a good impact.*

Keywords: Smoke-free, university, policy, second-hand smoke, smoking

INTRODUCTION

It has been estimated that there are more than 1.1 billion smokers worldwide, with an estimated 945 million male smokers as compared to 180 million female smokers¹. Various studies have proven that tobacco usage can harm human health and that it is the main reason for premature, preventable death^{2,3}. Tobacco usage causes 7 million deaths every year⁴, and if the trend of tobacco usage remains until 2030, more than 8 million people will perish yearly from diseases related to tobacco usage⁵.

To prevent tobacco usage from gradually becoming a health crisis, the World Health Organization (WHO) established the Framework Convention on Tobacco Control (FCTC) to protect current and future generations from the negative impact of tobacco usage and to reduce second-hand smoke (SHS) to the public^{6,7}. The establishment of smoke-free areas has the potential to reduce tobacco usage in public areas, encourage smokers to quit, reduce SHS, and establish conducive environments^{8,9}. Universities are one of the zones declared as smoke-free areas.

In 2018, 13.7% of United States citizens (equivalent to 34.2 million people) aged ≥18 years were smokers, and smokers aged 25-44 years comprised the highest percentage thereof¹⁰. Smoking among youth is very alarming and

worrying for public health. A study conducted in the US reported almost all smokers (98%) started smoking before the age of 26 years¹¹. This scenario has made universities a relevant location for preventing smoking and aiding smokers in quitting their addiction at the early stage of life. Quitting smoking before the age of 30 years, as compared to continuing to smoke, can reduce the risk of developing lung cancer by more than 90%¹².

Since 2012, the number of universities that have implemented the smoke-free campus policy has increased every year¹³. Up until July 1, 2020, at least 2,511 US universities had a smoke-free campus policy and had banned all smoking-related activities from the entire campus¹⁴. This policy has produced a conducive environment for university residents regardless of whether they are smokers or non-smokers. The policy establishes an environment that helps smokers reduce cigarette consumption and subsequently encourages them to quit smoking. Thus, reducing or banning smoking activities in university helps to protect non-smokers.

One of the main theories related to policy compliance with the smoke-free campus is the theory of planned behavior (TPB)¹⁵. According to the TPB^{16,17}, intention is the possibility that will influence the behavior, and is the most important indicator in predetermining the behavior. Intention is indicated by a combination of three global factors: attitude toward action, perceived

normative pressure, and perceived behavioral control¹⁸. Compliance with the smoke-free policy requires the following three factors: positive attitudes towards a smoke-free campus policy, negative attitudes towards smoking, and positive smoking behavior.

Here, we conducted the present review to document published studies on the attitudes and behaviors towards the smoke-free campus policy. Understanding such attitudes and behaviors can aid policymakers and researchers in escalating the effectiveness of the policy for the benefit and well-being of all university residents.

METHODS

We conducted a systematic review of the academic literature to identify published information on the behaviors and attitudes towards the smoke-free campus policy. We followed the structure of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement and used the PICO (Population, Intervention, Comparator, Outcome) methodology¹⁹. The search involved three main electronic databases: Ovid MEDLINE, ScienceDirect, and Scopus. These databases were selected because they primarily contain articles covering subject areas relevant to the topic being investigated: public health, healthcare sciences, and social behavior, and our university is subscribed to them. We searched the databases with the following Boolean string: [(smoke-free OR tobacco-free) AND (campus OR university OR college) AND (knowledge* OR attitude* OR practice*)]. The systematic search for published articles was verified in January 2010 to December 2020.

The database search returned a total of 2,579 studies: 259 from ScienceDirect, 271 from Scopus, and 2,049 from Ovid MEDLINE (Fig 1). A total of 35 duplicate studies were identified, leaving a total of 2,544 studies. The title and abstract of each study were screened according to the inclusion

and exclusion criteria. Studies were excluded if they were written in languages other than English. In this review, both qualitative and quantitative studies on university residents' attitudes and behaviors towards a smoke-free campus policy were included. The target group was required to involve both smoking and non-smoking university students. Only universities that had implemented the smoke-free campus policy were included in this study. The selected studies had to have measured both the impact of smoking behaviors and attitudes towards smoking or a smoke-free campus policy. Systematic reviews, commentaries, essays, and consensus statements were excluded from this review.

We excluded a further 2,493 titles and abstracts unrelated to the attitudes and behaviors towards the smoke-free campus policy from this study. The full text of 51 studies was included for further evaluation. We read the full text of these studies and made independent decisions regarding their inclusion or exclusion based on the above criteria. Of the 51 studies, 34 did not specifically evaluate the attitudes and behaviors towards the policy, and were excluded. Figure 1 shows the article selection flow diagram.

Methodological quality

All authors evaluated each study, and consensus was required to ensure and guarantee the quality of the study chosen. The main flaw of the selected studies was self-reporting, on which 17 studies were based and which can influence and create biased responses. Further, the ability to generalize study outcomes required consideration because most of the study locations selected were limited to specific locations (i.e., only involved one department or one campus or one university). Eight studies used simple random sampling that induced bias²⁰⁻²⁷, seven studies had low response rates^{20,22,24,25,28-30}, and two studies did not state the study limitations^{23,31}.

Figure 1. PRISMA diagram of the study selection process.

RESULTS

Table 1 summarizes the articles selected in this review with regard to the attitudes and behaviors towards the smoke-free campus policy, and other impacts. Table 2 shows a summary of the variables reviewed in the selected articles. According to the Table 1 and Table 2, all seventeen studies measured smoking behavior. Eight out of seventeen studies had positive impact, six studies reported negative impact, and other studies reported mixed results. Eleven studies investigating SHS exposure reported that respondents were still exposed to SHS in university. Seven of the twelve studies that measured attitudes toward smoke-free campus policy reported positive attitudes toward the policy. There were ten studies that measured attitudes towards smoking reported negative impact. In addition, all twelve studies that measured support for smoke-free campus reported positive support. Two studies that measured behavior towards smoking reported negative impact, and three studies that assessed awareness of smoke-free campus policy reported higher awareness among respondents.

DISCUSSION

The smoke-free campus policy is a practical initiative for the sustainability and well-being of the university neighborhood. Studying the impact of the smoke-free campus policy and evaluating previous studies can increase understanding of the impact and university resident compliance with the policy. The evaluation of the selected studies showed diverse impacts of the policy on university residents. Regarding the impact of attitudes towards the smoke-free campus policy, seven out of twelve studies reported positive attitudes^{22,24,27-29,31,36}. The respondents felt that the policy could contribute to a positive impact on health and keep the campus clear of cigarette butts. The establishment of the smoke-free campus policy can elevate the university's image to the public^{24,30}. Nevertheless, two studies reported negative attitudes towards the policy^{25,26}. In those studies, the respondents felt that the policy created a negative stigma against smokers and denied smokers' individual rights. The respondents also believed that smokers would not obey the rules and that enforcing the policy would burden the university's enforcement officers³⁰.

Table 1. A summary of studies included in the review.

Author	Study description	Country of origin	Objectives	Outcomes	Limitations
Wong et al. (2020) ²⁰	<p>Sample size: 2,000 (survey); 5,953 (poll)</p> <p>Response rate: 37.5% ($n = 754$, survey); 37.2% ($n = 2,218$, poll)</p> <p>Sampling: Stratified sampling (survey), simple random sampling for students (poll); convenience sampling for staff (poll)</p> <p>Methods: Mixed method (environmental scan, cigarette butt audit, faculty and staff health risk appraisal, student substance use survey, policy opinion poll)</p> <p>Target group: Students and employees</p> <p>Source of sample: A private university in California</p> <p>Funding source: CVS Health/American Cancer Society Tobacco-Free Campus Generation Initiative grant; National Heart, Lung, and Blood Institute; National Cancer Institute</p>	US	Assess cigarette and e-cigarette use and characterize the climate for adopting a comprehensive tobacco-free policy	<p>SHS exposure: In the past 30 days, SHS exposure was none (43%) and 1-3 times (43%)</p> <p>Attitudes towards a smoke-free campus: Most respondents endorsed the benefits of supporting health, ensuring tobacco-free air to breathe, reducing litter, preventing tobacco use and fires, and helping tobacco users quit. In contrast, the majority of respondents was concerned about stigmatizing smoking, personal freedoms, or the start of a slippery slope</p> <p>Smoking behavior: Findings indicate low tobacco use prevalence among the campus community, yet a large volume of butt litter was found on campus; tobacco clean-up costs were high</p> <p>Support for a smoke-free campus: The majority of respondents favored a campus-wide tobacco-free policy</p>	Low response rate; some parts of sampling were convenience sampling. Observing people smoking could alter their behavior. Limited generalization of the study because it only focused on one private university campus
Feldman et al. (2016) ²¹	<p>Sample size: 449</p> <p>Response rate: 72.5% ($n = 313$)</p>	Israel	Examine smoking behaviors, cigarette smoke exposure, and attitudes towards the	<p>SHS exposure: Most respondents reported daily exposure or exposure several times a week</p> <p>Attitudes towards a smoke-free campus:</p>	Choice of target population (School of Pharmacy second-year students and employees);

	<p>Sampling: Convenience sampling</p> <p>Methods: Self-administered questionnaire</p> <p>Target group: Students and employees</p> <p>Source of sample: Hebrew University Hadassah Ein Kerem</p> <p>Funding source: No external funding</p>		smoke-free campus policy among students and employees	<p>Most respondents (majority was non-smokers) agreed that smokers should smoke only in outdoor designated areas and that all campus buildings should be completely smoke-free. Only a minority agreed that a policy prohibiting smoking was unfair to smokers</p> <p>Smoking behavior: The majority of respondents reported seeing people smoke in open campus areas and indoors</p> <p>Support for a smoke-free campus: Most respondents supported the smoking ban inside buildings but fewer supported a complete ban of smoking throughout the campus, including outside areas. Support for a complete ban on smoking on campus was higher among non-smokers than among smokers</p>	despite the high response rate, the results could still be biased if those who did not participate had differing smoking behavior or attitudes from the participants
Gatto et al. (2018) ²²	<p>Sample size: Students (n = 40,123); faculty/staff (n = 7,884)</p> <p>Response rate: 9.3% (n = 5,242)</p> <p>Sampling: Convenience sampling</p> <p>Methods: Mixed method (online survey, counting cigarette butts found on the ground, Geographical Information System [GIS] mapping)</p> <p>Target group: Students and employees</p> <p>Source of sample: University of South Florida</p> <p>Funding source: Not mentioned</p>	US	Evaluate the enforcement, opinions, and effectiveness of the university's tobacco-free policy 1 year following implementation	<p>SHS exposure: Approximately half of the respondents identified that they were exposed to SHS following implementation</p> <p>Attitudes towards a smoke-free campus: Smokers were less likely than non-smokers to believe the tobacco-free campus policy had reduced tobacco use</p> <p>Smoking behavior: The majority of respondents witnessed tobacco use on campus. Most smokers were in the stage of change, or not enforcing the policy and not thinking about doing so, while the majority of non-smokers was in the pre-contemplation stage</p> <p>Behavior towards smoking: The majority of respondents were in the pre-contemplation stage (they did not approach the violator to inform them of the policy and had no intention to do so in the future for cigarette use, chewing tobacco, and e-cigarettes). Those who did not approach smoking violators had multiple reasons, including being unsure if they should address it and being uncomfortable</p> <p>Awareness of smoke-free campus policy: More than half of the respondents correctly identified the university's smoking policy</p>	For observation methods, times could not be randomized due to the volunteers' schedule limitations, and data were only collected during daylight hours due to safety concerns. There was a limit to the information available on violators, and the ArcGIS observations, e.g., smokeless tobacco, leaves little observation evidence of use or disposal; the study used convenience sampling
Almutairi (2014) ³²	<p>Sample size: 4,591</p> <p>Response rate: Not applicable</p>	Saudi Arabia	Compare the prevalence of smoking among students, faculty, and staff;	<p>Attitudes towards smoking: The majority of respondents (mostly non-smokers) agreed with the effects of smoking if someone smoked around them. Non-smokers were least likely to agree that</p>	Limited generalizability (only involved the KSU community); the study was based on self-reporting

	<p>Sampling: Random sampling</p> <p>Methods: Self-administered questionnaire</p> <p>Target group: Students and staff</p> <p>Source of sample: King Saud University (KSU)</p> <p>Funding source: Research Centre at the College of Applied Medical Sciences and the Deanship of Scientific Research at KSU</p>	<p>examine their interest to quit; determine the difference in perceptions of smoking and non-smoking students, faculty, and staff with regard to implementation of a smoke-free policy</p>	<p>smoking is a personal freedom, and almost all smokers agreed with this statement</p> <p><u>Smoking behavior:</u> About half of the smokers within the university had attempted to quit smoking</p> <p><u>Support for a smoke-free campus:</u> The majority of respondents were supportive of a smoke-free policy and indicated that it should be strictly enforced, especially in public places. Smokers were more likely to support a smoke-free policy if there were no fines or penalties</p>	
<p>Chaaya et al. (2015)³¹</p>	<p>Sample size: 545</p> <p>Response rate: 98% (<i>n</i> = 535)</p> <p>Sampling: Stratified cluster sampling</p> <p>Methods: Self-administered survey</p> <p>Target group: Students</p> <p>Source of sample: American University of Beirut (AUB)</p> <p>Funding source: Research for International Tobacco Control, an International Development Research Centre secretariat</p>	<p>Lebanon</p> <p>Examine students' compliance and attitudes following the campus non-smoking policy</p>	<p><u>Attitudes towards a smoke-free campus:</u> The majority of respondents were satisfied to a large extent with the ban and considered it justified. Only a minority reported that the ban would help reduce smoking to a large extent or that it would help smokers quit. Most respondents thought that the ban contributed somewhat or to a large extent to creating a healthy environment</p> <p><u>Smoking behavior:</u> The majority of respondents agreed that the ban would help smokers decrease smoking but would have no effect on cessation</p> <p><u>Support for a smoke-free campus:</u> Only 45% of non-smokers supported AUB becoming entirely smoke-free, as opposed to only 10.2% of regular smokers</p>	<p>Not mentioned</p>

Burns et al. (2016) ²⁸	<p>Sample size: 5,000</p> <p>Response rate: Before: 19.4% (<i>n</i> = 969) After 1 year: 13.4% (<i>n</i> = 670)</p> <p>Sampling: Random sampling</p> <p>Methods: Emailed survey</p> <p>Target group: Students and staff</p> <p>Source of sample: A large Western Australian university</p> <p>Funding source: Not mentioned</p>	Australia	Evaluate a total smoking ban at a large Australian university	<p>SHS exposure: SHS exposure was reduced significantly 1 year after policy implementation, but only a minority had never been exposed to SHS, indicating that SHS exposure remained present</p> <p>Attitudes towards a smoke-free campus: There was a significant increase in positive responses to the statement that the campus should be totally smoke-free 1 year after policy implementation</p> <p>Attitudes towards smoking: General attitudes were negative.</p> <p>Smoking behavior: Smoking prevalence was similar for both periods; over half of the smokers indicated that they were planning to quit smoking in the future</p> <p>Support for a smoke-free campus: There was strong support that all campus buildings should be smoke-free during both periods</p> <p>Awareness of smoke-free campus policy: Increased significantly 1 year after policy implementation</p>	The cross-sectional nature of the study precluded any causal effects; the low proportion of smokers who participated in the survey may have been due to selective non-reporting or under-reporting and the low response rate
Lechner et al. (2014) ³³	<p>Sample size: Baseline: 1,119 2008: 1,178 2009: 1,237 2010: 1,242</p> <p>Response rate: Not applicable</p> <p>Sampling: Cluster sampling</p> <p>Methods: Self-report questionnaire</p> <p>Target group: Students</p> <p>Source of sample: A large Midwestern university</p> <p>Funding source: Not mentioned</p>	US	Examine the effectiveness of a campus-wide anti-tobacco program using pre-post data across a 4-year period. Smoking prevalence, behaviors, attitudes, and beliefs were assessed via self-report at four time points	<p>SHS exposure: Respondents reported significant decreases in SHS exposure immediately after the ban and campaign were initiated</p> <p>Attitudes towards smoking: Respondents' beliefs about nicotine's ability to serve as a weight loss supplement decreased over time; preference for socializing in a smoke-free environment increased significantly following the ban</p> <p>Smoking behavior: The percentage of more frequent smokers and less frequent smokers decreased across assessment points.</p>	The lack of a control campus for comparison; the lack of data available to confirm the stability of some of the significant trends reported; the lack of the inclusion of a biological measure (such as cotinine) to confirm the accuracy of the decline in self-reported smoking
Butler et al. (2012) ²⁹	<p>Sample size: 1,700</p> <p>Response rate:</p>	US	Assess attitudes and behaviors related to the smoke-free policy	<p>Attitudes towards a smoke-free campus: The majority of respondents living on campus as compared to those living off campus rated the policy as</p>	The low response rate and the overrepresentation of women in the full sample

	30% (n = 360) Sampling: Random sampling Methods: Emailed survey Target group: Students Source of sample: A public university in the South Funding source: National Centre for Research Resources, Office of the Director, National Institutes of Health (NIH); supported by the NIH Roadmap for Medical Research		among undergraduate students and alcohol drinkers on a campus in a community with smoke-free bars	“very important”. Only a smaller percentage of current smokers compared with non-smokers rated the smoke-free campus policy as “very important” Smoking behavior: The majority of smokers said the smoke-free law had no effect on their motivation to quit smoking and no effect on the number of cigarettes they smoked daily Support for a smoke-free campus: Overall, there was support for the policy in campus buildings	and in the subsample of alcohol users
Gauthier et al. (2013) ²³	Sample size: 1,282 Response rate: Not applicable Sampling: Convenience sampling Methods: Online survey Target group: Students, employees, contract workers Source of sample: Laurentian University Funding source: None	Canada	Gain a better sense of the prevalence of smoking and SHS exposure in a geographically isolated post-secondary context; assess the awareness of existing non-smoking initiatives; identify preferred approaches for tobacco control	SHS exposure: The majority of respondents reported that they had been exposed to SHS in the past month on campus Attitudes towards smoking: Most respondents (majority was non-smokers) said that being exposed to cigarette smoke bothered them. Half of the respondents felt that smoking should only be allowed in designated outdoor smoking areas; some felt that smoking should not be allowed anywhere on campus; only a minority felt that smoking should be allowed anywhere outdoors on campus Smoking behavior: The majority of smokers had tried to quit smoking; most indicated they planned to quit within the next year. Only a few smokers felt that further restrictions on campus would increase their likelihood of quitting Behavior towards smoking: Only a minority of respondents had ever actually asked someone to stop smoking in their presence	Not mentioned
Ramachandran et al. (2020) ³⁴	Sample size: 1,704 Response rate: 93% (n = 1,541)	US	Estimate the prevalence of smoking behavior on campus; identify the key factors	SHS exposure: The majority of respondents reported being exposed to SHS on campus at least once; some reported altering their walk on campus to avoid cigarette smoke	This study used self-reporting and also did not delineate the use of e-cigarettes and regular

	<p>Sampling: Random sampling</p> <p>Methods: Self-administered survey</p> <p>Target group: Students</p> <p>Source of sample: University of Mississippi</p> <p>Funding source: Not mentioned</p>	that influence adherence to a campus smoke-free policy	<p>Attitudes towards smoking: Non-smokers had more negative attitudes towards smoking than smokers</p> <p>Smoking behavior: More than half of the smokers reported still smoking on campus. The majority of respondents reported witnessing someone smoking on campus</p> <p>Support for a smoke-free campus: Non-smokers had higher negative scores than smokers in supporting a smoke-free campus</p>	cigarettes. Although a large sample was obtained, these data were collected 4 years ago; some of the findings may have changed since then. Finally, generalization to other universities must be made with caution	
Gong et al. (2016) ³⁵	<p>Sample size: 711</p> <p>Response rate: Not applicable</p> <p>Sampling: Multistage sampling</p> <p>Methods: Internet survey</p> <p>Target group: Students</p> <p>Source of sample: 37 colleges in Beijing</p> <p>Funding source: National Natural Science Foundation of China</p>	China	Evaluate the implementation of the Tobacco-Free Campus Policy (TFCP) in Beijing	<p>SHS exposure: The majority of respondents were exposed to SHS on campus at least once in the past month</p> <p>Attitudes towards smoking: Most respondents were aware of the harms but only a few respondents tried to stop their last SHS exposure indoors and outdoors</p> <p>Smoking behavior: The majority of both smokers and non-smokers reported seeing a teacher and classmate smoking in campus buildings</p>	This study was based on convenience sampling; the majority of respondents were from college campuses, which have upper bounds for tobacco control measures in China; this was a descriptive study designed to track TFCP implementation from the users' experience perspective
Bartington et al. (2020) ²⁴	<p>Sample size: 38,000</p> <p>Response rate: 2.5% (<i>n</i> = 934)</p> <p>Sampling: Convenience sampling</p> <p>Methods: Web-based questionnaire</p> <p>Target group: Students and staff</p> <p>Source of sample: University of Birmingham</p> <p>Funding source:</p>	United Kingdom	Collect baseline data among staff and students; measure smoking behaviors and attitudes towards the introduction of campus-wide tobacco control policies within a UK higher education setting	<p>Attitudes towards a smoke-free campus: The majority of respondents reported that a smoke-free campus policy would improve staff and student health and the university's public image. However, the majority of smokers also felt that the policy would discriminate against and disadvantage smokers, with fewer non-smokers considering that it would be a discriminative policy</p> <p>Attitudes towards smoking: The majority of respondents agreed that staff and students should not be exposed to SHS on campus, supported the aspiration for a smoke-free university campus, and endorsed restrictions on tobacco sales</p>	Low response rate, males were slightly underrepresented, use of a self-administered questionnaire (self-reported); the element of selective nonresponse bias may have resulted in more positive attitudes towards tobacco control policies than among the total university population

None		<p>Smoking behavior: Almost half of the current smokers reported they wished to quit smoking and almost one-third had attempted to quit within the previous 12 months. However, the majority had smoked on campus</p> <p>Support for a smoke-free campus: Overall, more than half of the respondents supported a smoke-free campus and endorsed restrictions for tobacco sales; just under half of the respondents supported a ban on e-cigarette/vaping device use on campus (the highest level of support was among non-smokers)</p>			
Wray et al. (2020) ²⁵	<p>Sample size: 2016: 16,829 2017: 16,749</p> <p>Response rate: 2016: 13.5% (<i>n</i> = 2,277) 2017: 10.21% (<i>n</i> = 1,206)</p> <p>Sampling: Convenience sampling</p> <p>Methods: Mixed methods (Online surveys and open-ended questions in 2017 survey)</p> <p>Target group: Students and employees</p> <p>Source of sample: University of Missouri</p> <p>Funding source: None</p>	US	Assess the impact on tobacco- and policy-related perceptions and behaviors	<p>Attitudes towards a smoke-free campus: The perception that individuals would comply with the policy were low; perceptions that tobacco policies are hard to enforce were relatively high</p> <p>Attitudes towards smoking: Among the respondents, perceived acceptability of tobacco use was decreased; norms disapproving tobacco use were increased after policy implementation</p> <p>Smoking behavior: Self-reported use of any tobacco decreased after the ban was enacted</p> <p>Support for a smoke-free campus: Policy support and norms disapproving tobacco use on campus increased</p>	The data were collected using separate cross-sectional surveys each year; all items were self-reported. The biggest threat to validity was the unexpected and large decline in student participation in year 2 of the university surveys
Bamashmous (2018) ²⁶	<p>Sample size: 380</p> <p>Response rate: 82.4% (<i>n</i> = 313)</p> <p>Sampling: Convenience sampling</p> <p>Methods: Self-administered paper-based questionnaire</p>	Saudi Arabia	Assess determinants of support for a smoke-free university policy among dental students, evaluate awareness and compliance with the policy, assess and identify factors	<p>SHS exposure: Less than half of the respondents were exposed to SHS in the university, their household, and at their friends' houses</p> <p>Attitudes towards a smoke-free campus: Only 38% thought that this policy was followed or enforced</p> <p>Attitudes towards smoking:</p>	Small sample size and potential recall bias, self-reporting bias, social desirability. The study was limited to dental students, who might show different characteristics from those of other faculties

	Target group: Students Source of sample: King Abdulaziz University Funding source: Not mentioned	affecting support for the policy	Being non-smokers, women had better knowledge of smoking hazards and were less lenient in accepting SHS exposure Smoking behavior: About one-fifth of the respondents reported that they smelled smoke at the university; the majority saw cigarette filters on the ground at least sometimes; less than half reported that they were exposed to SHS at university Support for a smoke-free campus: The multivariate model showed a direct relationship of support for a smoke-free university policy with being a non-smoker and having greater knowledge of smoking health hazards Awareness of smoke-free campus policy: About half of the respondents knew that there was a policy on smoking on campus; 64% knew that the policy banned smoking anywhere on campus	
Martínez et al. (2016) ³⁶	Sample size: 517 Response rate: 74.3% (n = 384) Sampling: Not mentioned Methods: Self-administered questionnaire Target group: Students Source of sample: Univesitat Internacional de Catalunya (UIC Barcelona) Funding source: Consell de Col·legis d'Infermers i Infermeres de Catalunya	Spain	Assess attitudes towards the extension of outdoor smoke-free areas on university campuses SHS exposure: Most respondents reported exposure to smoke on campus. Non-smokers were exposed to SHS in outdoor areas where smoking was allowed Attitudes towards a smoke-free campus: The majority of respondents reported believing that the university complied with the indoor smoking ban, but fewer agreed on the compliance with the outdoor ban Smoking behavior: Outdoor smoke-free policies were associated with a drop in student smoking rates Support for a smoke-free campus: The respondents (majority was non-smokers) expressed strong support for indoor smoke-free policies; however, only 39.3% of participants supported regulating outdoor smoking for university campuses	Mostly due to the use of a self-administered questionnaire, SHS exposure data were self-reported and did not use biomarkers for detecting exposure; cross-sectional study design; did not assess socioeconomic status, which would have been useful for adjusting the analysis for this variable; selection bias could not be ruled out, given that 25% of registered students did not attend class on the day the survey was conducted
Hall et al. (2015) ²⁷	Sample size: 462 Response rate:	US	Assess attitudes among various college campus populations Attitudes towards a smoke-free campus: Male respondents were less likely than female respondents to oppose the feasibility of designated	Participants were volunteers rather than a random sample (may have

	Not applicable		relative to smoking, SHS exposure, and the acceptability of campus tobacco policies for developing effective, targeted implementation strategies	smoking areas; staff members were more likely than students to agree with policy development and enforcement Attitudes towards smoking: Female respondents were more likely to report being bothered by SHS, along with a stronger belief in the dangers associated with SHS Smoking behavior: Older respondents may have had more experience with attempts at quitting and recognized the need for assistance when making this behavior change	introduced selection bias); “tobacco use” as delimited to smoking cigarettes, which is a subset of tobacco use behavior
Berg et al. (2011) ³⁰	Sample size: Online survey: 8,834 Focus group discussion: 73 Response rate: 30.6% ($n = 2,700$): online survey Sampling: Random sampling Methods: Mix method (online survey and focus group discussion) Target group: Students Source of sample: Two colleges in the Midwest Funding source: ClearWay Minnesota	US	Examine attitudes regarding public and campus smoke-free policies, the implementation of private policies, and specific factors related to reactions to smoke-free policies among students at a 2-year college and a 4-year university	SHS exposure: The vast majority recognized the impact of the policies on reducing SHS exposure Attitudes towards a smoke-free campus: The respondents reported concern about the appearance of their campuses and believed that more smoking restrictions would result in improved campus cleanliness. Their concerns also included the burden these policies imposed on smokers, and difficulty enforcing the rules Smoking behavior: Smokers generally approved of the ban because of its impact on reducing smoking Support for a smoke free campus: Most respondents strongly supported smoke-free policies in public, on campus, and in private spaces	It included two colleges in the Midwest, and may not reflect the demographics of US colleges, thus limiting generalizability; the high rates of support for smoke-free policies might be reflective of the sample’s higher socioeconomic background; details regarding the nature of the respondents’ homes/dwellings were not assessed; smoking status was assessed using self-report and may have resulted in biased reporting; the cross-sectional nature of the data did not allow causality to be determined

Table 2. A summary of the variables investigated in the studies.

Study	Variable						
	SHS exposure	Attitudes towards a smoke-free campus policy	Attitudes towards smoking	Smoking behavior	Support for a smoke-free campus	Behavior towards smoking	Awareness of smoke-free campus policy
Wong et al. (2020) ²⁰	✓	✓		✓	✓		
Feldman et al. (2016) ²¹	✓	✓		✓	✓		
Gatto et al. (2018) ²²	✓	✓		✓		✓	✓
Almutairi (2014) ³²			✓	✓	✓		
Chaaya et al. (2015) ³¹		✓		✓	✓		
Burns et al. (2016) ²⁸	✓	✓	✓	✓	✓		✓
Lechner et al. (2014) ³³	✓		✓	✓			
Butler et al. (2012) ²⁹		✓		✓	✓		
Gauthier et al. (2013) ²³	✓		✓	✓		✓	
Ramachandran et al. (2020) ³⁴	✓		✓	✓	✓		
Gong et al. (2016) ³⁵	✓		✓	✓			
Bartington et al. (2020) ²⁴		✓	✓	✓	✓		
Wray et al. (2020) ²⁵		✓	✓	✓	✓		
Bamashmous (2018) ²⁶	✓	✓	✓	✓	✓		✓
Martínez et al. (2016) ³⁶	✓	✓		✓	✓		
Hall et al. (2015) ²⁷		✓	✓	✓			
Berg et al. (2011) ³⁰	✓	✓		✓	✓		

All ten studies that examined the attitudes towards smoking reported negative attitudes towards smoking^{23-28,32,33,35}. In those studies, the respondents believed that smoking is an annoying habit, bad for health, unacceptable social practice, and that cigarette smoke is suffocating. With reference to the TPB, negative attitudes toward smoking are a good indicator, as they assume smoking is bad practice and therefore can predict the respondent's behavior in complying with the smoke-free policy¹⁵.

Eight studies reported a positive impact for smoking behaviors among smokers^{23,25,27,28,30,32,33,36}, whereas six studies reported negative impacts^{21,22,26,29,34,35}; three studies reported mixed negative and positive impacts^{20,24,31}. Positive behaviors help smokers quit smoking, attempt to quit smoking, plan to quit smoking, and reduce daily cigarette consumption. There were also smokers with negative behaviors who felt that the policy did not have a positive impact on them to quit smoking, and they continued to smoke on campus and litter their cigarette butts on campus. All 11 studies that measured SHS exposure^{20,21,36,22,23,26,28,30,33-35} reported that respondents were still exposed to SHS at university as a consequence of smokers' negative behaviors; in seven studies, more than 50% of the respondents were exposed to SHS^{20,21,23,28,34-36}. Further, two studies that measured the behaviors towards smoking reported that more than 60% of respondents would not approach and reprimand smokers to stop smoking and adhere to smoke-free campus policy^{22,23}. The uncertainty on how smokers should be reprimanded and the desire to avoid confrontation between the respondents and smokers were the respondents' reasons for why they avoided approaching smokers.

Twelve studies evaluated the support and awareness of the smoke-free campus policy. All 12 studies reported positive support, especially the banning of smoking in university buildings^{20,21,34,36,24-26,28-32}. Nevertheless, the support differed between smokers and non-smokers and later contributed to the supporting majority as compared to support from the smokers. Three studies on awareness^{22,26,28} reported that the majority of respondents knew about the existence of the smoke-free campus policy, and more than 60% of respondents managed to answer questions regarding the policy correctly²². One study reported a strong relation between awareness of the policy and support of a smoke-free campus²¹. Higher awareness of the smoke-free campus policy increased support for the policy.

LIMITATIONS

One limitation of this review is that the literature search was conducted using electronic databases to which our university is subscribed. It is possible that we might have missed some important studies. Further, the studies reviewed were from January 2010 to December 2020, and we assumed that studies prior to this date were irrelevant to the latest practice. The effectiveness of the impact of the smoke-free campus policy on smokers' attitudes and behaviors might differ between the studies included in this review, as some studies did not report the policy in detail or report the duration the policy had been implemented prior to the study being conducted. Lastly, the smoke-free campaign was launched not only in universities, but also more in public domains that every community can access. It is possible that the impact of attitudes towards a smoke-free campus and smoking behavior was not solely influenced by the smoke-free campus policy.

CONCLUSIONS

Despite the limitations of the study, we have presented a review of studies from all over the world regarding attitudes towards the smoke-free campus policy and smoking behavior, as compared to the review by Dillitott et al.³⁷, which focused only on North American universities. We found that the smoke-free campus policy can influence smokers' behavior in reducing smoking activities in the university, subsequently achieving the policy's goal of preventing SHS exposure. Some areas can be improved during the implementation to increase the impact of the policy. The majority of the studies reported positive impacts on smoking behavior; however, all of the studies reported that SHS exposure persisted and that cigarette butts were still found on campus due to smokers obstinately smoking on university grounds in hidden or isolated areas, for example, toilets, back alleys, staircases, or fences³⁸. Thus, to increase the effectiveness of the policy, the responsible party of the university should tighten enforcement, intensify the promotion of awareness of the policy, and provide counselling services or quit smoking clinics to aid smokers in quitting smoking.

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CONFLICT OF INTEREST

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