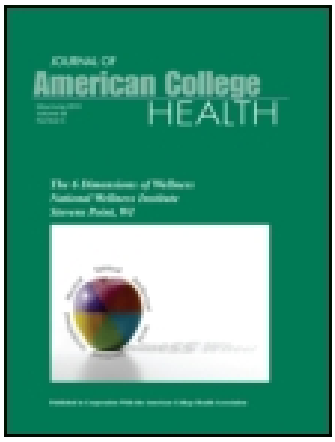

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Major Article

Impact of the Adoption of Tobacco-Free Campus Policies on Student Enrollment at Colleges and Universities, North Carolina, 2001–2010

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Abstract. Objective: College and university administrators have expressed concern that adoption of tobacco-free policies may reduce applications and enrollment. This study examines adoption and implementation of 100% tobacco-free campus policies by institutions of higher education on applications and enrollment. **Participants**: North Carolina private colleges and universities and public community colleges. Analysis was conducted in 2011. **Methods**: Student enrollment and application data were analyzed by campus type to determine (a) if there was a difference in student applications and enrollment before and after policy implementation, and (b) if there was a difference in student applications and enrollment for campuses with versus without a policy. **Results**: No significant differences were found in student enrollment or applications when comparing years prior to and following policy implementation or when comparing with institutions without 100% tobacco-free campus policies. **Conclusions**: The authors found no evidence that 100% tobacco-free policy adoption had an impact on student enrollment or applications.

Keywords: organizational policies, policy making, school enrollment, smoking, universities

Tobacco use remains the leading cause of preventable illness and death in the United States.[1] Young adults attending college have rates of smoking between 17% and 26%[2–4]; community college students likely have even higher risk of smoking.[5] Furthermore, secondhand smoke exposure causes heart disease and lung cancer in nonsmokers, and there is no risk-free level of exposure.[6] College students in North Carolina (NC) have historically had high levels of exposure from secondhand smoke.[7] The Centers for Disease Control and Prevention have outlined best practices that focus on the creation of tobacco-free environments through comprehensive tobacco control efforts as the only means for fully protecting the public from secondhand smoke exposure.[8] In response to the recognized health hazards of tobacco dependence and involuntary exposure to tobacco, the American College Health Association advocates for the adoption of tobacco-free policies by colleges and universities.[9]

As of October 1, 2014, approximately 976 campuses in the United States have adopted comprehensive tobacco-free policies.[10] A quarter of both public and private colleges and universities and over 50% of community colleges are tobacco-free in NC.[11] Despite findings indicating that tobacco-free policies are commonly supported by both students[12–15] and staff/faculty,[16] many administrators have been reluctant to adopt tobacco control policies out of fear of student objection,[17] including that of potential future students.[18–21] Our own work on the NC Tobacco-Free Colleges Initiative[22] suggests 2 common perceived barriers: (1) questions over the effectiveness of tobacco-free policies and (2) fear of lower application and/or enrollment rates.

Widespread evidence exists for the effectiveness of smoke-free workplaces, schools, and public spaces.[23] Two studies extend this research to college campuses. A pre–post survey with a matched control school found a significantly reduced smoking prevalence among undergraduate students after implementation of a smoke-free policy at a large public university.[24] Research in NC has found a

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significant negative association between the strength of tobacco-related policies and the amount of cigarette litter near campus building entrances.[25]

However, little research has examined the second concern (ie, fear of lower application and/or enrollment rates). Most research has examined perceptions and intentions rather than behavioral outcomes (ie, applications for admission) and has provided equivocal results. For example, undergraduate students (smokers and nonsmokers) of a Minnesota 4-year university ($n = 1{,}512$) and a technical college ($n = 748$) were asked, "What effect, if any, do you think a policy making this campus completely smoke-free would have on: student quality of life, student learning, and student enrollment?"[12] Nearly 31% indicated that such a policy would have a positive impact on enrollment, and another 41.2% indicated that it would have no impact on enrollment. However, in follow-up focus groups with only students who were smokers, a theme regarding how such a policy might impact enrollment was noted but not explored.

The attitudes and perceptions of faculty, staff, and students concerning the likely impact of tobacco-free policies at a university campus in Kentucky were examined by Mishra and colleagues.[14] Of the 2,914 respondents to a campus-wide questionnaire, 71% of whom were undergraduate students, 44% disagreed that a smoke-free campus policy would *increase* enrollment; however, 60% agreed that such a policy would improve the quality of life of students on campus.

Gerson and colleagues explored the impact of adoption of smoke-free residence hall policies by 3 large universities (Montana State University, Ohio State University, and the University of Rhode Island).[19] The researchers found that demand for student housing maintained a similar trajectory or remained stable at each of the institutions. Student retention rates and new student application rates were not impacted negatively either but in fact increased or remained stable across institutions. The authors concluded the policy change had not led to anticipated negative consequences such as student resistance, costly enforcement, or revenue lost.

The study detailed in this article sought to explore the impact of adoption and implementation of 100% tobacco-free campus policies on enrollment and application numbers at NC institutions of higher education. Two hypotheses were proposed:

H1: Institutions have fewer applications and lower enrollment after implementation of a tobacco-free campus policy.

H2: Institutions that have adopted and implemented a tobacco-free campus policy have fewer applications and lower enrollment than those that have not.

METHODS

Two types of campuses were included, NC community colleges ($n = 58$) and member institutions of the Association of NC Independent Colleges and Universities (ie, private institutions; $n = 36$). None of the 4-year public universities in NC have a 100% tobacco-free policy due to state legislation that only allows tobacco use to be banned within 100 feet of buildings on these campuses. Thus, public universities were not included in this study.

Using a list of NC tobacco-free colleges maintained by The University of North Carolina Tobacco Prevention and Evaluation Program as part of the NC Tobacco-Free Colleges Initiative,[26] institutions of each campus type (ie, community college, private institutions) were divided into those that had adopted and implemented a 100% tobacco-free policy by the fall semester of 2010 (community colleges, $n = 28$; private institutions, $n = 9$) and those that had not (community colleges, $n = 30$; private institutions, $n = 27$). To ensure accuracy of our data, a systematic search process described elsewhere identified policies at campuses not participating in the NC Tobacco-Free Colleges Initiative.[11] For each institution that had adopted a tobacco-free policy, the fall semester in which the policy was first implemented was also noted for analysis purposes (Table 1).

Student enrollment data for community colleges in academic years 2001 through 2010 were obtained from NC Community College System Annual Statistical Reports.[27] Variables included curriculum, continuing education, and total student enrollment (ie, curriculum and continuing education enrollment not including duplication of students in both programs) for both the fall and spring semesters of each academic year. Student application and enrollment data for private institutions for the same academic years were obtained from the NC Statistical Abstract of Higher Education.[28] Variables included in-state, out-of-state, and total student enrollment for the fall semester of each academic year and the number of in-state and out-of-state freshmen and transfer applications received.

To account for natural variability that may occur in student applications and enrollment from year to year, an average was computed for specific ranges of the time order data. A large range of time could lower the variability, but it may not adequately account for slower changes in the diffusion of information and behaviors. The time ranges analyzed for this study were 1, 2, and 3 years before and after a policy was implemented.

Data analysis was conducted using SAS (version 9.2; SAS Institute, Cary, North Carolina). A p value of less than .05 was established as the significance threshold, and all analyses were conducted using 1-tailed tests. Analyses were stratified by type of institution (private, community college). Variables were examined for normality; given substantial nonnormality among variables, nonparametric tests were utilized. Where normality was present, a parametric test was also conducted; as results did not change, all analyses are reported using the nonparametric tests.

For H1, the analysis was limited to schools that adopted policies and each outcome variable was compared before and after policy implementation. This was done for 3 time

TABLE 1. Policy Group and No- or Partial-Policy Group, North Carolina, 2001–2010

	Tobacco-free campus policy			No- or partial-policy group
Campus type	Year implemented	No. implemented	Total no.	Total no.
Private institution ($n = 36$)	2004	1	9	27
	2006	1		
	2007	1		
	2008	3		
	2009	3		
Community college ($n = 58$)	2007	4	28	30
	2008	4		
	2009	8		
	2010	12		

ranges: 1, 2, and 3 years before and after policy implementation. For example, for the 2-year range, the average outcome variable for the 2 years before and the 2 years after policy implementation at each school was computed, and these 2 averages were then compared in a paired test. This was repeated for the other time ranges, except in cases where time ranges were outside of the study period. A Wilcoxon signed-rank test, the nonparametric equivalent of a paired *t* test, was performed.

For hypothesis 2, the difference in the outcome variable was calculated between the time period after and the time period before policy implementation for each institution. To control for institution size (eg, 1 campus having annual enrollments of over 10,000 students, whereas most have 2,000 or less), differences between the 2 averages were divided by the average value of the outcome variable before the policy implementation. The comparison group consisted of institutions with no policy change during the study period, and all time ranges across the study period were calculated, as there was no before and after period. That is, for the 2-year ranges, the differences of 2-year average outcome variables before and after implementation at each campus with policy change were compared with *all* average 2-year differences in the study period at institutions with no policy implementation. The equivalent of the 2-sample *t* test, the Wilcoxon rank-sum test, was used.

Conducting multiple statistical tests increases the chances of type I errors (ie, incorrectly rejecting the null hypothesis). To account for this, false discovery rates (FDR) control is a statistical method used to adjust for the number of comparisons being made.[29] FDR adjustments were calculated for all results of the Wilcoxon signed-rank and Wilcoxon rank-sum tests and are less restrictive than Bonferroni adjustments.[30]

RESULTS

When testing whether applications and enrollment were lower before and after institutions implemented a tobacco-free policy (hypothesis 1), only one *p* value was below the significance threshold (.05) (Table 2). Within the 1-year range, enrollment in continuing education programs during the spring semester appeared to be significantly different ($p = .03$). However, the FDR adjustment *p* value for this variable was .99, well above the significance threshold. Hence, no significant evidence was found to indicate that there were fewer applications and lower enrollment after policy implementation.

When testing whether there was a significant decrease in applications and enrollment for campuses that implemented tobacco-free policies compared with those that did not (H2), only 2 significant cases were found (Table 3). In-state transfer applications ($p = .02$) and total transfer applications ($p = .02$), both within the 1-year range, at private institutions appeared to have *p* values below the significance threshold. The adjusted FDR *p* values ($p = .55$ for both) were well above the significance threshold. Thus, significant evidence was not found to indicate fewer applications and lower enrollment at schools with policy implementation than without policy implementation.

COMMENT

This study sought to examine if a perceived barrier—reduced application and enrollment due to adoption of tobacco-free policies—is borne out by actual behavior by exploring the impact of 100% tobacco-free policies on student applications and enrollment at NC community colleges and private colleges and universities. Unsurprisingly, given high levels of student support[15] and widespread publicity on the harms of secondhand smoke, we found that adoption of tobacco-free policies had no negative impact on application rates or student enrollment. Furthermore, no differences in student applications and enrollment were found between campuses that had implemented policies and those that had not. These findings held true for both private colleges and universities and public community colleges. Our findings parallel earlier pilot research on smoke-free residence hall policies.[19] Other researchers, using college student study participants, have also reported that well-communicated tobacco-free policy implementation can increase

TABLE 2. Distribution of Applications and Enrollment Before and After Implementation of a Tobacco-Free Campus Policy, North Carolina, 2001–2010 ($N = 37$)

Variable	Time range (years)	p	p after FDR adjustment
Private institutions ($n = 9$)			
IS enrollment	1	.50	.99
	2	.82	.99
	3	.80	.99
OS enrollment	1	.77	.99
	2	.73	.99
	3	.95	.99
Total enrollment	1	.86	.99
	2	.96	.99
	3	.84	.99
IS freshmen applications	1	.88	.99
	2	.99	.99
	3	.98	.99
OS freshmen applications	1	.52	.99
	2	.98	.99
	3	.91	.99
Total freshmen applications	1	.96	.99
	2	.99	.99
	3	.98	.99
IS transfer applications	1	.12	.99
	2	.32	.99
	3	.50	.99
OS transfer applications	1	.20	.99
	2	.34	.99
	3	.78	.99
Total transfer applications	1	.07	.99
	2	.16	.99
	3	.42	.99
Community colleges ($n = 28$)			
Curr fall enrollment	1	> .99	.99
	2	> .99	.99
	3	.99	.99
CE fall enrollment	1	.60	.99
	2	.30	.99
	3	.88	.99
Total fall enrollment	1	.95	.99
	2	> .99	.99
	3	> .99	.99
Curr spring enrollment	1	> .99	.99
	2	> .99	.99
	3	.99	.99
CE spring enrollment	1	.03	.99
	2	.12	.99
	3	.50	.99
Total spring enrollment	1	.44	.99
	2	.98	.99
	3	.99	.99

Note. FDR = false discovery rate; IS = in-state; OS = out-of-state; Curr = curriculum programs; CE = continuing education programs. A p value of less than .05 provides evidence for the hypothesis that applications and enrollment outcomes decrease after implementation, and a p value of $\geq .05$ indicates that there is not significant evidence to reject the null hypothesis of no change.

organizational attraction among potential employees.[31] Colleges can create health-promoting campuses,[32] and such work can be an important part of ecological approaches to student development.[33] Changing the normative relationship with tobacco may make tobacco-free policies a selling point of a modern, wellness-centered college brand.

Limitations

The results of this study are subject to a number of limitations that should be taken into consideration. First, only campuses in NC were included, limiting the generalizability of its findings. Since 2008, NC law has required school districts to adopt tobacco-free campus policies (NC SB

TABLE 3. Difference in Applications and Enrollment Between Institutions That Have Adopted Tobacco-Free Campus Policies and Those That Have Not, 2001–2010

Variable	Time range (years)	*p*	*p* after FDR adjustment
Private institutions			
IS enrollment	1	.39	.92
	2	.70	.92
	3	.64	.92
OS enrollment	1	.68	.92
	2	.52	.92
	3	.83	.92
Total enrollment	1	.74	.92
	2	.97	.97
	3	.80	.92
IS freshmen applications	1	.62	.92
	2	.46	.92
	3	.31	.92
OS freshmen applications	1	.52	.92
	2	.72	.92
	3	.59	.92
Total freshmen apps	1	.77	.92
	2	.87	.92
	3	.44	.92
IS transfer applications	1	.02	.55
	2	.28	.92
	3	.28	.92
OS transfer applications	1	.12	.88
	2	.08	.69
	3	.17	.92
Total transfer apps	1	.02	.55
	2	.06	.69
	3	.07	.69
Community colleges			
Curr fall enrollment	1	.40	.92
	2	.65	.92
	3	.85	.92
CE fall enrollment	1	.55	.92
	2	.44	.92
	3	.86	.92
Total fall enrollment	1	.46	.92
	2	.53	.92
	3	.95	.97
Curr spring enrollment	1	.28	.92
	2	.62	.92
	3	.86	.92
CE spring enrollment	1	.39	.92
	2	.30	.92
	3	.64	.92
Total spring enrollment	1	.16	.92
	2	.30	.92
	3	.88	.92

Note. FDR = false discovery rate; IS = in-state; OS = out-of-state; Curr = curriculum programs; CE = continuing education programs. Because the window from schools with policy change is compared with all of the same-length time-period ranges in the study period (eg, all differences of 2-year averages) among institutions with no policy change, the *n* includes multiple time periods per comparison institution and exceeds the number of institutions. *N*s for private policy adoption institutions have missing data and zeros for some outcome variables. Thus, the *n* for private institutions ranges between 7–9 and 121–135, 7–9 and 109–135, and 5–6 and 84–108, respectively, for policy and nonpolicy institutions in the 1-, 2-, and 3-year ranges. There were no zeros or missing data for community colleges. Thus, the *n* for community colleges is 28 and 120, 16 and 90, and 8 and 60, respectively, for policy and nonpolicy institutions in the 1-, 2-, and 3-year ranges. A *p* value of less than .05 provides evidence for the hypothesis that applications and enrollment outcomes decrease, and a *p* value of $\geq$.05 indicates that there is not significant evidence to reject the null hypothesis of no difference.

1086). Therefore, in-state students may expect tobacco-free campus policies and may even have an expectation that they will continue to be protected from secondhand smoke once accessing higher education settings. Nonetheless, as the leading tobacco-producing state and home of 2 of the "big three" US tobacco companies, NC is often considered

tobacco-friendly,[34] which may predispose students to respond negatively to limitations on their use of tobacco in any setting. Although future research should explore the impact of tobacco-free policies on student applications and enrollment in other geographies, students may be even more open to protections from secondhand smoke in non–tobacco-producing states. Other states with fully tobacco-free public universities should consider replicating this study to identify if the same patterns hold for public universities. Additional research on organizational attraction and message framing is needed, as are more precise quantifications of the impact of tobacco-free policies on student, faculty, and staff behavior. Second, the small sample was a limiting factor of this study. Third, the available data constrained the ability to calculate longer-term impacts on enrollment for policies implemented toward the end of the study period. Given that a substantial proportion of policies were implemented during this period, this study may not be able to identify longer-term changes among these campuses.

Conclusions

Our study reaffirms earlier pilot research in which Gerson and colleagues noted, "The implications for college and university administrators are clear. In moving forward with smoke-free policies, they should not assume that this type of policy change would cause a burden to the university."[19(pp163–164)] This paper provides evidence that adoption of tobacco-free campus policies by institutions of higher education has no negative impact on student applications and enrollment for admission. Campus administrators can consider 100% tobacco-free policies as part of comprehensive health promotion efforts without fear of negative financial implications due to decreased student applications or enrollment.

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CONFLICT OF INTEREST DISCLOSURE

The authors have no conflicts of interest to report. The authors confirm that the research presented in this article met the ethical guidelines, including adherence to the legal requirements, of the United States. Because no human subjects were involved in this research, Institutional Review Board approval was not sought.

NOTE

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