

Original Investigation

Tobacco Use by Male Prisoners Under an Indoor Smoking Ban

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Abstract

Introduction: Most correctional facilities have implemented tobacco restrictions in an effort to reduce costs and improve prisoner health, but little has been done to evaluate the impact of these policy changes. Patterns of tobacco use among prisoners were explored to determine the impact of incarceration in a facility with an indoor smoking ban on tobacco use behaviors.

Methods: Recently incarcerated male inmates ($n = 200$) were surveyed about their tobacco use prior to and during incarceration.

Results: Tobacco use was prevalent prior to arrest (77.5%) and increased during incarceration (81.0%). Though the number of cigarette smokers increased during imprisonment, per-capita cigarette consumption declined by 7.1 cigarettes/day ($p < .001$). Despite widespread tobacco use, most participants recognized that smoking is a cause of lung cancer (96.0%) and heart disease (75.4%) and that it can be addicting (97.5%). Most tobacco users (70.0%) reported a desire to quit, with 63.0% saying they intended to try quitting in the next year.

Conclusions: Indoor smoking bans do not promote cessation in prisons but may reduce the amount of tobacco consumed. Though smoking is commonplace in prisons, most prisoners recognize the risks involved and wish to quit. This creates an ideal setting for intervention. Evidence-based cessation assistance should be made freely available to all incarcerated smokers.

Introduction

More than 1.5 million people are currently being held in U.S. prisons, and each year, some 13 million people pass through American jails (Sabol & Couture, 2008; Sabol & Minton, 2008). All told, more than 1% of American adults are incarcerated at any given time (Warren, Gelb, Horowitz, & Riordan, 2008). The cost of caring for the residents of these facilities falls to the states. As of 2008, annual state expenditures on corrections were

\$49 billion, a cost expected to climb to nearly \$75 billion by 2011 (Warren et al., 2008).

The state is legally and ethically obligated to safeguard the health of prisoners. The financial cost of prisoner health care is substantial, and the prison population is expanding and aging (Fazel, Hope, O'Donnell, Piper, & Jacoby, 2001; Flynn, 1992). In addition, prisoners tend to be less healthy and less educated than the general population and exhibit higher rates of some negative health behaviors like high-risk sexual behaviors, drug use, and smoking (Glaser & Greifinger, 1993; Jacobi, 2005; Voglewede & Noel, 2004). Without targeted efforts to improve prisoner health, the economic burden of incarceration will continue escalating.

As gathering points of high-risk individuals, jails and prisons may act as “epidemiological pumps,” wherein disease and disease-causing behaviors are amplified by inter-resident transmission then carried home with prisoners upon release (Jacobi, 2005). This creates an opportunity for public health interventions to both improve prisoners' health and to limit effects on their communities.

Tobacco control has an important role to play in such efforts. The prevalence of smoking among incarcerated individuals has consistently been found to be much higher than in the general population, with 60%–80% of prisoners choosing to smoke (Conklin, Lincoln, & Tuthill, 2000; K. Cropsey, Eldridge, & Ladner, 2004; National Commission on Correctional Health Care, 2001; Vaughn & del Carmen, 1993). Historically, many facilities included tobacco in prisoner rations (Gray, 2001; Griffiths, 1894). Though prisons in the United States no longer distribute free tobacco (Kauffman, Ferketich, & Wewers, 2008), about half of state prison systems surveyed still engaged in the practice in the mid-1980s (Romero & Connell, 1988).

Unchecked smoking negatively impacts prison air quality and consequently prisoner's health (U.S. Public Health Service, Office of the Surgeon General, 2006). In one prison where smoking was unregulated, secondhand smoke concentrations in the living quarters ranged from 1.5 to as much as 12 times greater

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than the average concentration in smokers' homes (Hammond & Emmons, 2005). Concerns over health effects of secondhand smoke exposure have led some nonsmoking inmates to challenge incarceration in smoking areas. One case, *Helling v. McKinney*, resulted in a Supreme Court ruling that secondhand smoke exposure could constitute cruel and unusual punishment (White, 1993; Wilcox, 2007).

This ruling, combined with concerns over the increasing cost of inmate healthcare, has led many prison systems to implement tobacco restrictions for prisoners in the form of smoke-free living areas, indoor smoking bans, or total tobacco bans in their institutions. A recent survey of prison tobacco policies in American prisons found that 60% of prison systems have total bans and an additional 27% ban smoking inside buildings (Kauffman et al., 2008).

Despite the high prevalence of tobacco smoking among inmates and a swiftly changing regulatory landscape, only five studies have examined prison tobacco policies and their impact on prisoner smoking behaviors (K. L. Cropsey & Kristeller, 2005; Foley, Proescholdbell, Herndon Malek, & Johnson, 2010; Hammond & Emmons, 2005; Lankenau, 2001; Proescholdbell, Foley, Johnson, & Herndon Malek, 2008). Of these, one focused solely on female prisoners (K. L. Cropsey & Kristeller, 2005), two measured behavior change indirectly by examining air quality (Hammond & Emmons, 2005; Proescholdbell et al., 2008), and two were qualitative studies (Foley et al., 2010; Lankenau, 2001); all studies focused on total smoking bans rather than on indoor smoking restrictions. This is the first quantitative study on the impact of prison smoking restrictions on male prisoners' tobacco use behaviors and the only study to examine the effect of indoor tobacco bans on tobacco use behaviors.

Methods

Setting

A survey was conducted among 200 consecutively admitted recently arrived male prisoners in low-to-medium security Ohio facilities. Five prisons located within an hour of the Ohio State University, where the study was centered, were considered for inclusion in the study. Three declined participation due to ongoing or recent involvement with other research projects. The remaining two facilities are hereafter identified as "Institution A" and "Institution B." At the time the project was undertaken, the Ohio Department of Rehabilitation and Correction (ODRC) banned the use of tobacco products in and around the entrances of all buildings on prison grounds (Collins, 2006).

At Institution A, located in west-central Ohio, no smoking was allowed inside any building on the prison grounds. Prisoners did not have access to outdoor areas during scheduled population counts or during the night, effectively banning smoking during those periods; however, prisoners had access to outdoor areas during much of the day and could legally smoke outside during those times. In addition to a state-mandated indoor ban, administrators at Institution B, located in a county bordering Ohio's Appalachian region, removed supplies for hand-rolling cigarettes from the commissary. Table 1 compares tobacco-related products available for purchase in the two facilities.

Sample

Consecutive sampling was used to select a representative sample of 200 incoming men (100 per facility). The ODRC central office generated a list of inmates admitted to the system in the fourteen weeks prior to the interviews. Recruitment was carried out individually at the initial meeting with a potential participant. To be eligible, individuals had to be ≥18 years old, speak English well enough to complete the instrument, and reside in the general population of the facility at the time of the interview. Individuals held in segregation (solitary confinement) or undergoing medical care during the study period were not included in the study. Those outside the prison during the study due to court appearances or release were also excluded. If an individual was eligible and elected to participate, the consent process and interview commenced immediately. In compliance with state law, participation was not incentivized. Study procedures were approved by the Ohio State University Institutional

Table 1. Comparison of Availability and Pricing of Tobacco Products at Two Low-to-Medium Security Ohio Prisons

Item	Institution A	Institution B
Manufactured cigarettes		
Camel cigarettes, filtered or nonfiltered (one pack)	\$4.74	–
Kool cigarettes (one pack)	\$4.89	–
Marlboro cigarettes (one pack)	\$4.65	\$4.84 ^a
Newport cigarettes (one pack)	\$4.76	–
Pall Mall cigarettes (one pack)	\$4.76	–
Generic nonfiltered cigarettes (one pack)	\$3.10	–
Generic filtered cigarettes (one pack)	\$3.50	\$3.95 ^a
Generic menthol filtered cigarettes (one pack)	\$3.51	\$3.95 ^a
Generic menthol 100's cigarettes (one pack)	\$3.14	–
Hand-rolled cigarettes		
Rolling papers (100 leaves)	\$0.46	–
Bugler tobacco (one can)	\$8.19	–
Bugler tobacco (one pouch)	\$1.05	–
Captain Black tobacco (one pouch)	\$3.80	–
Cherry Blend tobacco (one pouch)	\$2.41	–
Kite tobacco (one can)	\$8.19	–
Kite tobacco (one pouch)	\$1.05	–
Cigars		
Black & Mild cigars (one pack)	\$2.35	–
A & C little cigars (one pack)	\$3.64	–
Smokeless tobacco		
Kayak snuff (one can)	\$1.82	\$1.32
Timber Wolf snuff (one can)	\$3.21	–
Grizzly snuff (one can)	–	\$1.84
Kodiak snuff (one can)	–	\$4.50
Red Man chewing tobacco (one pouch)	\$3.42	–
Nicotine replacement therapy		
Nicotine gum (25 pieces)	\$21.51	\$21.40
Nicotine patches, Steps 1–4 (14 patches)	\$48.26	\$37.45

Note. ^aAvailable only in "Ultra light."

Review Board, and a Certificate of Confidentiality was obtained from the Centers for Disease Control and Prevention to protect study data from subpoena.

Survey Instrument

Interviews were conducted on site using a computer-assisted personal interview system. Demographic data were collected, and participants were surveyed about their tobacco use prior to and during incarceration using a modified National Health and Nutrition Examination Survey tobacco questionnaire (National Center for Health Statistics, 1996). Questions covered cigarettes, pipe smoking, cigars, snuff, and chewing tobacco. To assess compliance with current policies, participants were asked about their indoor tobacco use while incarcerated. Questions on desire to quit, number of quit attempts, and methods used to quit were also included, adapted from those in the National Health Interview Survey. Other tobacco-related measures were the Fagerström Test for Nicotine Dependence (Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991) and questions about the health impacts of tobacco use (Stratton, 2005).

One researcher, with experience interviewing prisoners, administered all surveys. Interviews were conducted in a private classroom or office with only the interviewer and participant present. Interviews took approximately 30 min to complete, including the consent process.

Tobacco Use Classification

Self-reports were used to categorize patterns of tobacco use. Biomarkers (expired carbon monoxide and salivary cotinine) support the validity of self-reported tobacco use in this sample (Kauffman, Ferketich, Murray, Bellair, & Wewers, 2010). Participants were classified as *ever users* if they had used the threshold amount of a product: 100 cigarettes or 20 times using a pipe, cigars, snuff, or chewing tobacco (National Center for Health Statistics, 1996). Individuals using less than these thresholds were termed *never users*. Ever users reporting no current tobacco use were classified as *former users*. Current cigarette, cigar, and/or pipe users were termed “smokers”; those currently using snuff and/or chewing tobacco were *smokeless user*. Those currently using both smoked and smokeless tobacco products were termed “dual users.”

Statistical Analysis

Studies of noninstitutionalized populations have found the prevalence of tobacco use behaviors to be higher in Ohio Appalachia than other parts of the state (Ferketich & Sahr, 2009; Renaud, Ray, Homsi, Salib, & Hersey, 2006); therefore, Fisher’s exact test was used to check for differences in the distribution of smoking behaviors between prisoners sentenced from Appalachian and non-Appalachian counties. Comparisons were conducted for tobacco use behaviors both prior to and during incarceration.

Fisher’s exact test was also used to examine the impact of past tobacco behavior (never smoking vs. ever smoking) on prison tobacco initiation among nonusers (never users and former users) and to compare the likelihood of increased tobacco consumption between racial/ethnic groups (non-Hispanic White vs. other) and those sentenced from Appalachian versus non-Appalachian counties. McNemar’s test for paired data was

used to examine changes in the prevalence of nonuse, current smoking, current smokeless use, and dual use associated with the transition to prison. A paired *t* test was used to examine changes in cigarette consumption as measured in average cigarettes per day (cpd). A Wilcoxon’s sign-rank test was used to assess changes in the frequency of smokeless tobacco use (ordinal variable: every day, somedays, and not at all) following entry into prison.

Results

Sample Characteristics

In order to obtain a sample of 200 eligible consenting participants, 322 consecutively admitted men were reviewed, 40 of whom were excluded for failing to meet one or more of the eligibility criteria. Of those eligible, 70.9% consented to participate in the study. Participant demographics are presented in Table 2.

Table 2. Sample Demographics Compared With a Representative Sample of Ohio Prisoners Admitted During the Study Period

	Study sample (<i>n</i> = 200)	All incoming Ohio inmates ^a (<i>n</i> = 3,383)
Age, mean (<i>SD</i>)	33.8 (10.2)	32.3 (10.2)
Race, %		
Non-Hispanic White	63.5	48.7
Non-Hispanic Black	35.0	48.6
Hispanic	1.5	2.3
Other	0.0	0.4
Region of sentencing county, %		
Appalachian	22.0	9.0
Non-Appalachian	78.0	91.0
Education, %		
Less than HS	34.5	41.8
GED certificate.	18.0	20.6
HS graduate	26.5	21.0
At least some college	21.0	16.6
Marital status, %		
Single/cohabiting	66.0	69.7
Married	11.0	10.0
Separated	7.5	6.7
Divorced	14.0	13.0
Widowed	1.5	0.6
Most serious offense, %		
Crimes against persons (not sex)	26.5	23.8
Sex offenses	3.0	7.2
Burglary offenses	9.5	8.5
Miscellaneous property offenses	23.5	15.3
Drug offenses	25.5	29.2
Motor vehicle offenses	0.5	1.5
Fraud offenses	2.5	2.8
Firearm offenses	3.0	4.2
Offenses against public administration	6.0	7.6

Note. HS = high school; GED = general education development certificate. ^aSource: Bates, Gonzalez, and Muncy (2008).

Tobacco use by male prisoners

Due to the geographic location of the prisons in the study, prisoners sentenced from the Ohio Appalachia region were more prevalent in the study (22.0%) than in the Ohio prison population (9.0%) as a whole (Renaud et al., 2006).

Preincarceration Tobacco Use

Figure 1 summarizes patterns of tobacco use prior to and during imprisonment. Prior to arrest, 74.0% of the participants were current cigarette smokers. The vast majority of cigarette smokers (90.5%, 67.0% of the sample) smoked every day. Daily cigarette smokers consumed an average of about one pack (23.1 ± 14.4 cpd) of cpd. Ever cigarette smokers had a mean age at initiation of 15.8 ± 4.3 years old (range: 7–35).

Use of other forms of smoked tobacco was less common in the sample. There were 92 individuals in the sample (46.0%) who reported smoking cigars at some point in their lives, though most of these ($n = 59$, 64.1%) reported that they never smoked cigars regularly. Prior to their arrest, 12 participants (6.0%) were daily cigar smokers. Daily cigar smokers were composed of 11.4% and 3.1% of Black and White participants, respectively. There were also 18 participants (9.0%) who were someday cigar smokers, including 12.9% of Black participants and 7.1% of White participants. The majority of current cigar smokers (86.7%) reported also being current cigarette smokers during the period prior to their arrest. Only two participants (1.0%) were current pipe smokers at the time of their arrest. Both reported infrequent pipe use and concurrent cigarette smoking.

At the time of arrest, 71 participants (35.5%) were ever smokeless tobacco users; 34 participants (17.0%) were current smokeless users, of whom six (3.0% of sample) used smokeless tobacco on a daily basis. Most smokeless users used only snuff (85.3%), with the remainder using chewing tobacco alone (5.9%) or both snuff and chew (8.8%). Users of smokeless tobacco tended to be non-Hispanic Whites (88.2%), and half were sentenced from Appalachian counties ($n = 17$, 50.0%). Those sentenced from Appalachia were significantly more likely to be current smokeless users compared with non-Appalachian prisoners (38.6% vs. 10.9%, $p < .001$). Only three participants reported using only smokeless tobacco at the time of their arrest; most ($n = 31$, 15.5%) reported dual use of smoked and smokeless tobacco products.

Prison Tobacco Use

During the transition to prison life, more than a quarter of participants (28.0%) changed their tobacco use status

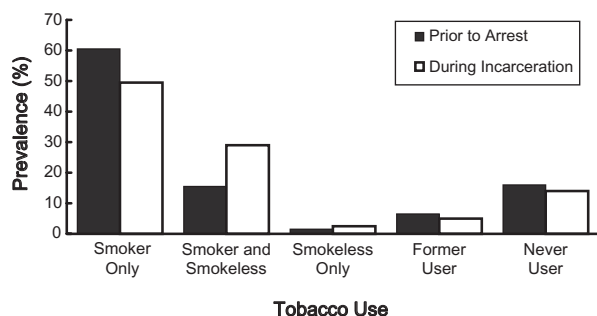


Figure 1. Prevalence of tobacco use behaviors prior to arrest and during incarceration in a sample of 200 low-to-medium security male prisoners.

(Supplementary Table). About a quarter of preincarceration smokers ($n = 31$, 25.6%) initiated smokeless tobacco use in prison. Most nonusers continued to abstain from tobacco (71.1%); however, more than a quarter started smoking ($n = 10$, 22.2%) using smokeless tobacco ($n = 2$, 4.4%) or both ($n = 1$, 2.2%). Former tobacco users were significantly more likely than never users to initiate tobacco use in prison (69.2% vs. 12.5%, $p < .001$).

Most participants ($n = 163$, 81.5%) reported smoking cigarettes at least once since arriving at the facility. At the time of the interview, 156 participants (78.0%) were current smokers, including 129 (82.7%, 64.5% of sample) who were daily cigarette smokers. In prison, current cigarette smokers used about half a pack of cigarettes (10.6 ± 10.6 cpd) on days when they smoked, with daily cigarette smokers consuming 12.5 ± 10.6 cpd. More than half of cigarette smokers ($n = 84$, 51.2%) reported smoking indoors; a third ($n = 56$, 34.1%) reported doing so daily. The type of cigarettes smoked differed significantly at the two facilities ($p < .001$). The commissary at Institution B sold only manufactured cigarettes, leading all 82 smokers to use them. By contrast, at Institution A, the vast majority of prisoners (97.3%) smoked hand-rolled cigarettes.

Only six individuals (3.0%) reported someday cigar smoking, and just one person (0.5%) was a daily cigar smoker. An additional 22 participants smoked a cigar at least once during their imprisonment but reported smoking less than one cigar each week. Less than a quarter of cigar smokers (20.7%) reported ever using cigars indoors, and all who reported doing so said they rarely smoked cigars indoors. Tobacco pipes and related paraphernalia are not available through the commissary and are banned from prison grounds. No participants reported smoking a tobacco pipe during their incarceration.

Smokeless tobacco was used by 74 (37.0%) participants at least once since arriving at their current facility, with 34 (46.0%, 17.0% of sample) being daily smokeless users. There were 11 participants who reported using smokeless tobacco less than once per week in prison. The majority of smokeless users used only snuff ($n = 71$, 95.9%), the remainder used both snuff and chewing tobacco ($n = 3$, 4.1%). Most regular smokeless users were non-Hispanic Whites ($n = 54$, 85.7%). Smokeless tobacco use was significantly more prevalent in individuals sentenced in Appalachian counties as compared with those in non-Appalachian counties (56.8% vs. 24.4%, $p < .001$). Most smokeless users ($n = 67$, 90.5%) reported using smokeless tobacco products inside of buildings during their incarceration, with half of the smokeless users ($n = 37$, 50.0%) reporting daily indoor use.

Dual use of smoked and smokeless tobacco was reported by 58 (29.0%) individuals. This represents 36.9% of regular smokers and 92.1% of regular smokeless tobacco users. The dual users tended to be non-Hispanic Whites ($n = 50$, 86.2%). Participants sentenced from Appalachia were significantly more likely to be dual users (54.6%) than those who were not (21.8%, $p < .001$). Among the current dual users, 40.0% reported using only smokeless tobacco products indoors, including a third of dual users ($n = 10$, 31.3%) who initiated smokeless tobacco use after arriving in prison.

Level of Tobacco Consumption

At the time of arrest, 148 participants smoked cigarettes and per-capita cigarette consumption (including nonsmokers) was

15.7 ± 15.9 cpd. During incarceration, the number of smokers increased to 160, though the average number of cigarettes consumed per day fell to 8.6 ± 10.6 cpd. This 7.1 cpd decline in consumption was statistically significant ($p < .001$). Significant declines in cigarette consumption were observed at both Institution A (5.3 cpd, 95% CI: 2.8–7.8) and Institution B (9.0 cpd, 95% CI: 6.5–11.4).

In contrast, there was a significant increase in the frequency of smokeless tobacco consumption, with 52 participants (26.0%) increasing their use following incarceration and only 5 (2.5%) decreasing it ($p < .001$). Increased consumption of smokeless tobacco was independently associated with race/ethnicity ($p < .001$) and region of sentencing county ($p = .002$). Non-Hispanic Whites were more likely to increase their frequency of use during incarceration (36.2%) than participants from other racial or ethnic groups (8.2%). Men sentenced from Appalachian counties were more likely to increase their use (45.5%) compared with those who were not sentenced in Appalachia (20.5%).

Tobacco Knowledge and Desire to Quit

Most participants agreed with statements that smoking is a cause of lung cancer (96.0%) and heart disease (75.4%). Many participants were also aware that secondhand smoke could cause lung cancer (83.4%) or heart disease (48.2%), and nearly all recognized that tobacco use can be addicting or habit forming (97.5%).

Most men using tobacco at the time of the interview (70.0%) reported a desire to quit, with 63.0% indicating that it was likely or very likely they would try quitting within the next year. Most cigarette smokers (64.3%) made at least one 24-hr quit attempt (an effort to quit including at least 24 hr of smoking abstinence) prior to their arrest. Quit methods used included stopping cold turkey ($n = 78$, 77.2%), switching to smokeless tobacco ($n = 15$, 14.9%), tapering cigarette consumption prior to quitting ($n = 12$, 11.9%), and using nicotine patches ($n = 11$, 10.9%).

More than a quarter of incarcerated smokers ($n = 47$, 29.0%) reported at least one 24-hr quit attempt in prison. Methods tried were stopping cold turkey ($n = 36$, 76.6%), switching to smokeless tobacco ($n = 12$, 25.5%), and tapering consumption in advance of the attempt ($n = 5$, 10.6%). No participants reported taking part in the free prison-sponsored group counseling program for tobacco cessation or using nicotine replacement therapy (NRT, available through the commissary). Other cessation medications (e.g., varenicline, bupropion) are not generally available to prisoners through medical services and were therefore also not used. Only five smokers, 10.6% of those attempting to quit, reported success in quitting smoking. Of these, only three quit using all tobacco products; two men had ongoing tobacco use. An additional two participants had quit smoking during the period between their arrest and admission into the prison system

Discussion

This exploration of tobacco use among men incarcerated under an indoor smoking ban raises questions about the public health impact of such policies. Prior to arrest, the prevalence of smoking

in the sample (76.0%) was much greater than the 22.3% prevalence in the state from which the sample was drawn (Borawski, Trapl, Olds, & Subhas, 2007), and it increased during incarceration to a level (78.5%) comparable with that in prisons without tobacco restrictions (Conklin et al., 2000; K. Cropsey et al., 2004; National Commission on Correctional Health Care, 2001; Vaughn & del Carmen, 1993).

Despite widespread tobacco use, most participants were aware of the negative consequences of using tobacco products, and most tobacco users reported an interest in quitting. This mirrors survey results from the general population (Saad, 2009) and is consistent with research among female inmates (K. Cropsey et al., 2004). Behavioral markers indicate a genuine desire to quit: More than a quarter of cigarette smokers reported making at least one 24-hr quit attempt during incarceration.

Few participants succeeded in quitting, despite their intentions, perhaps as a result of the methods used to quit. Further study is needed of prisoner perspectives on cessation programming to explain low utilization of available treatment opportunities. There is no reason to suspect that group sessions are inherently unappealing to prisoners. Both facilities had active Alcoholics Anonymous and Narcotics Anonymous groups, yet similar tobacco cessation programs were absent.

Current guidelines recommend the use of nicotine replacement products or medications to assist with smoking cessation, and studies among female inmates have found such interventions to be effective in prisons (K. Cropsey et al., 2008; Fiore & U.S. Tobacco Use and Dependence Guideline Panel, 2008). By not providing access to varenicline and bupropion, prison systems ensure that prisoners will not use these effective cessation aids. Nicotine replacement products are sold through the prison commissary; however, unsubsidized, their cost is prohibitive for many Ohio prisoners, whose average monthly salary of \$18 must cover all commissary purchases, including toiletries and noncafeteria food (Paullo & Golon, 1997). It is unsurprising, then, that prisoners decide not to purchase NRT when gum costs more than a month's wages and patches more than double that.

Financial pressures may also explain another aspect of prison tobacco use: Despite an increase in the number of tobacco users, per-capita cigarette consumption decreased by 7.1 cigarettes during incarceration. Variations in policy implementation between study sites create an opportunity for an exploratory examination of how restricting the types of tobacco sold may impact tobacco use behaviors. Decreases were greater at Institution B, where only ultra-light manufactured cigarettes were available, than at Institution A, where cheaper, unfiltered hand-rolled cigarettes were sold. Economic examinations of tobacco consumption have confirmed that demand for cigarettes decreases with increasing cost (Laugesen & Meads, 1991). The role of cost in shaping behaviors may be even more important when expenditures on tobacco constitute a large proportion of an individual's discretionary income.

It is unclear what health effects the observed reductions in cigarette consumption might have on incarcerated smokers. Measuring tobacco consumption in cigarettes smoked per day may overestimate reductions in tobacco smoke exposure due to compensatory smoking behaviors. Both human and animal

studies have found that some individuals compensate for reduced duration of exposure by increasing intensity (A. C. Harris, Burroughs, Pentel, & LeSage, 2008; Hatsukami et al., 2006; Scherer, 1999). A meta-analysis found evidence that a reduction of 50% or more in tobacco consumption may lead to small improvements in health, including reductions in markers of cardiovascular risk and a decline in respiratory symptoms; however, there was no evidence of improved lung function and inconclusive results regarding mortality reductions (Pisinger & Godtfredsen, 2007). Among prisoners, the issue is further clouded by widespread use of unfiltered hand-rolled cigarettes, which increase the risk of lung cancer even more than filtered cigarettes (J. E. Harris, Thun, Mondul, & Calle, 2004). When available, nearly all participants selected this cheaper alternative.

Indoor tobacco bans can only be effective if followed. Despite a ban on smoking indoors, 51.2% of smokers (42.0% of prisoners) reported smoking indoors at least once, with 34.1% (28.0% of all participants) using tobacco products inside every day. These self-reported numbers likely underestimate the scope of the problem. Such violations would be consistent with findings from facilities with total tobacco bans, where contraband tobacco is a widespread problem (K. L. Cropsey & Kristeller, 2005; Lankenau, 2001). Still, prisoners at the research site indicated in conversations with the investigator that the smoking policy is generally enforced, and consistent with other reports (Hammond & Emmons, 2005; Proescholdbell et al., 2008), indoor restrictions dramatically reduce indoor concentrations of secondhand smoke.

Several strengths and weaknesses of the current study merit discussion. The utility of an exploratory study is directly related to its generalizability. In the current study, 70.9% of invited men agreed to participate despite a prohibition on incentives. This strong response rate, combined with consecutive sampling, provides a sample representative of recently arrived inmates at the facilities under study. A separate issue is the degree to which participants reflect all prisoners. As both sites are low-to-medium security facilities, caution should be taken in applying these findings to high security settings. The practice of placing prisoners as close to home or family as possible contributes to geographic variations in prison populations. Inmates at Institution B, located in a county bordering Ohio Appalachia, were more likely to have been sentenced from an Appalachian county. The smaller increases in smokeless tobacco use observed among non-Appalachian participants may better reflect the situation for prisoners from areas where smokeless tobacco products have lower familiarity and social acceptability.

In the current study, indoor smoking bans reduced prisoners' cigarette consumption and promoted cleaner indoor air for incarcerated smokers and nonsmokers alike; however, the potential health benefits of reduced tobacco consumption may be offset somewhat by compensatory smoking and increased use of unfiltered cigarettes during incarceration. There is evidence that implementation of tighter tobacco restrictions has been accompanied by reduced offerings of smoking cessation assistance (Kauffman et al., 2008). This study indicates that an indoor smoking ban does little to promote smoking cessation; therefore, implementation of such bans should not be used to justify scaling back cessation programming. Most incarcerated smokers desire to quit; helping them do so removes the handle

of this "epidemiological pump," benefiting not only prisoners and their families but also society at large. Evidence-based cessation assistance should be freely available to all incarcerated smokers if the goal of improving prisoners' long-term health is to be achieved.

Supplementary Material

Supplementary Table can be found online at <http://www.ntr.oxfordjournals.org>

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Declaration of Interests

None declared.

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References

- Bates, J., Gonzalez, C., & Muncy, V. (2008). *Ohio Department of Rehabilitation and Correction: 2007 Intake Study*. Columbus, OH: Ohio Department of Rehabilitation and Correction. Retrieved 28 February 2011 from <http://www.drc.state.oh.us/web/Reports/intake/Intake%202007.pdf>
- Borawski, E. A., Trapl, E. S., Olds, R. S., & Subhas, N. (2007). *Ohio adult tobacco report: 2006 Adult Tobacco Survey*. Ohio Tobacco Research and Evaluation Center, Case Western Reserve University. Retrieved from http://www.case.edu/affil/healthpromotion/Publications/2006_Ohio_ATS_Report.pdf
- Collins, T. J. (2006). *10-SAF-01: Smoke-free workplace*. Columbus, OH: Ohio Department of Rehabilitation and Correction.
- Conklin, T. J., Lincoln, T., & Tuthill, R. W. (2000). Self-reported health and prior health behaviors of newly admitted correctional inmates. *American Journal of Public Health, 90*, 1939–1941. Retrieved from <http://ajph.aphapublications.org/>
- Cropsey, K., Eldridge, G. D., & Ladner, T. (2004). Smoking among female prisoners: An ignored public health epidemic. *Addictive Behaviors, 29*, 425–431. doi:S0306460303001333 [pii]
- Cropsey, K., Eldridge, G. D., Weaver, M., Villalobos, G., Stitzer, M., & Best, A. (2008). Smoking cessation intervention

- for female prisoners: Addressing an urgent public health need. *American Journal of Public Health*, 98, 1894–1901. doi:10.2105/AJPH.2007.128207
- Cropsey, K. L., & Kristeller, J. L. (2005). The effects of a prison smoking ban on smoking behavior and withdrawal symptoms. *Addictive Behaviors*, 30, 589–594. doi:10.1016/j.addbeh.2004.07.003
- Fazel, S., Hope, T., O'Donnell, I., Piper, M., & Jacoby, R. (2001). Health of elderly male prisoners: Worse than the general population, worse than younger prisoners. *Age and Ageing*, 30, 403–407. doi: 10.1093/ageing/30.5.403
- Ferketich, A. K., & Sahr, T. R. (2009). *A profile of smokers in Ohio in 2008*. Health Policy Institute of Ohio. Retrieved 28 February 2011 from http://a5e8c023c8899218225edfa4b02e4d9734e01a28.gripelements.com/pdf/policybrief_tobacco.pdf
- Fiore, M. (2008). U.S. Tobacco Use and Dependence Guideline Panel. *Treating tobacco use and dependence: 2008 update. Clinical practice guideline (Vol. 2008)*. Rockville, MD: U.S. Dept. of Health and Human Services. Public Health Service. Retrieved 28 February 2011 from http://www.surgeongeneral.gov/tobacco/treating_tobacco_use08.pdf
- Flynn, E. E. (1992). The graying of America's prison population. *Prison Journal*, 72, 77–98. doi:10.1177/0032885592072001005
- Foley, K. L., Proescholdbell, S. K., Herndon Malek, S., & Johnson, J. (2010). Implementation and enforcement of tobacco bans in two prisons in North Carolina: A qualitative inquiry. *Journal of Correctional Health Care*, 16, 98–105. doi:10.1177/1078345809356522
- Glaser, J. B., & Greifinger, R. B. (1993). Correctional health care: A public health opportunity. *Annals of Internal Medicine*, 118, 139–145. Retrieved from <http://www.annals.org/>
- Gray, M. P. (2001). Economics on the inside. *The business of captivity: Elmira and its civil war prison* (pp. 74–88), Kent, OH: Kent State University Press.
- Griffiths, A. (1894). Some gentlemen gaol-birds. *Secrets of the prison-house, or, gaol studies and sketches* (pp. 105–112), London: Richard Clay & Sons, Ltd. Retrieved 28 February 2011 from <http://books.google.com/books?id=sTXtpznD94C>
- Hammond, S. K., & Emmons, K. M. (2005). Inmate exposure to secondhand smoke in correctional facilities and the impact of smoking restrictions. *Journal of Exposure Science and Environmental Epidemiology*, 15, 205–211. doi:10.1038/sj.jea.7500387 7500387 [pii]
- Harris, A. C., Burroughs, D., Pentel, P. R., & LeSage, M. G. (2008). Compensatory nicotine self-administration in rats during reduced access to nicotine: An animal model of smoking reduction. *Experimental & Clinical Psychopharmacology*, 16, 86–97. doi:2008-01365-009 [pii] 10.1037/1064-1297.16.1.86
- Harris, J. E., Thun, M. J., Mondul, A. M., & Calle, E. E. (2004). Cigarette tar yields in relation to mortality from lung cancer in the Cancer Prevention Study II Prospective Cohort, 1982–8. *British Medical Journal*, 328, 72. doi:10.1136/bmj.37936.585382.44 328/7431/72 [pii]
- Hatsukami, D. K., Le, C. T., Zhang, Y., Joseph, A. M., Mooney, M. E., Carmella, S. G., et al. (2006). Toxicant exposure in cigarette reducers versus light smokers. *Cancer Epidemiology, Biomarkers & Prevention*, 15, 2355–2358. doi:15/12/2355 [pii] 10.1158/1055-9965.EPI-06-0240
- Heatherton, T. F., Kozlowski, L. T., Frecker, R. C., & Fagerstrom, K. O. (1991). The Fagerstrom Test for Nicotine Dependence: A revision of the Fagerstrom Tolerance Questionnaire. *British Journal of Addiction*, 86, 1119–1127. doi: 10.1111/j.1360-0443.1991.tb01879.x
- Jacobi, J. V. (2005). Prison health, public health: Obligations and opportunities. *American Journal of Law & Medicine*, 31, 447–478.
- Kauffman, R. M., Ferketich, A. K., Murray, D. M., Bellair, P. E., & Wewers, M. E. (2010). Measuring tobacco use in a prison population. *Nicotine & Tobacco Research*, 12, 582–588. doi:10.1093/ntr/ntq048
- Kauffman, R. M., Ferketich, A. K., & Wewers, M. E. (2008). Tobacco policy in American prisons, 2007. *Tobacco Control*, 17, 357–360. doi:tc.2007.024448 [pii] 10.1136/tc.2007.024448
- Lankenau, S. E. (2001). Smoke 'Em If You Got 'Em: Cigarette black markets in U.S. prisons and jails. *Prison Journal*, 81, 142–161. doi: 10.1177/0032885501081002002
- Laugesen, M., & Meads, C. (1991). Tobacco advertising restrictions, price, income and tobacco consumption in OECD countries, 1960–1986. *British Journal of Addiction*, 86, 1343–1354.
- National Center for Health Statistics. (1996). *NHANES III. Household adult data file documentation*. Author. Retrieved 28 February 2011 from ftp://ftp.cdc.gov/pub/Health_Statistics/NC_HS/nhanes/nhanes3/1A/ADULT-acc.pdf
- National Commission on Correctional Health Care. (2001). National Commission on Correctional Health Care Clinical Guideline for correctional facilities: Treatment of high blood cholesterol. *Journal of Correctional Health Care*, 8, 123–130. doi:10.1177/107834580100800204
- Paullo, G., & Golon, J. E. (1997). *Fiscal note & local impact statement: Am. Sub. S.B. 52122nd general assembly of Ohio*. Columbus, OH: Ohio Legislative Budget Office. Retrieved 28 February 2011 from <http://www.lsc.state.oh.us/fiscal/fiscalnotes/122ga/sb0052hr.pdf>
- Pisinger, C., & Godtfredsen, N. S. (2007). Is there a health benefit of reduced tobacco consumption? A systematic review. *Nicotine & Tobacco Research*, 9, 631–646. doi:779329648 [pii] 10.1080/14622200701365327
- Proescholdbell, S. K., Foley, K. L., Johnson, J., & Herndon Malek, S. (2008). Indoor air quality in prisons before and after implementation of a smoking ban law. *Tobacco Control*, 17, 123–127. doi:10.1136/tc.2007.022038
- Renaud, J., Ray, S., Homsy, G., Salib, S., & Hersey, J. (2006). *Results of the 2005 Ohio Adult Tobacco Survey: Regional report*. RTI International.

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- Romero, C. A., & Connell, F. A. (1988). A survey of prison policies regarding smoking and tobacco. *Journal of Prison & Jail Health, 7*, 27–36.
- Saad, L. (2009). *U.S. smoking rate still coming down*. Retrieved 28 February 2011 from <http://www.gallup.com/poll/109048/us-smoking-rate-still-coming-down.aspx>
- Sabol, W. J., & Couture, H. (2008). *Prison inmates at midyear 2007*. Bureau of Justice Statistics Bulletin. Retrieved 28 February 2011 from <http://bjs.ojp.usdoj.gov/content/pub/pdf/pim07.pdf>
- Sabol, W. J., & Minton, T. D. (2008). *Jail inmates at midyear 2007*. Bureau of Justice Statistics Bulletin. Retrieved 28 February 2011 from <http://bjs.ojp.usdoj.gov/content/pub/pdf/jim07.pdf>
- Scherer, G. (1999). Smoking behaviour and compensation: A review of the literature. *Psychopharmacology, 145*, 1–20. doi:10.1007/s002130051027
- Stratton, R. M. M. (2005). *Interactive communication technology and processing of behavioral health change messages (Master's thesis)*. Indianapolis, IN: Indiana University. Retrieved 28 February 2011 from <https://scholarworks.iupui.edu/handle/1805/332>
- U.S. Public Health Service, Office of the Surgeon General. (2006). *The health consequences of involuntary exposure to tobacco smoke: A report of the surgeon general*. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Office of the Surgeon General. Retrieved February 28 2011 from <http://www.surgeongeneral.gov/library/secondhandsmoke/report/fullreport.pdf>
- Vaughn, M. S., & del Carmen, R. V. (1993). Research note: Smoking in prisons—A national survey of correctional administrators in the United States. *Crime & Delinquency, 39*, 225–239. doi:10.1177/0011128793039002007
- Voglewede, J. P., & Noel, N. E. (2004). Predictors of current need to smoke in inmates of a smoke-free jail. *Addictive Behaviors, 29*, 343–348. doi:10.1016/j.addbeh.2003.08.048
- Warren, J., Gelb, A., Horowitz, J., & Riordan, J. (2008). *One in 100: Behind bars in America*. Pew Center on the States. Retrieved 28 February 2011 from http://www.pewcenteronthestates.org/uploadedFiles/8015PCTS_Prison08_FINAL_2-1-1_FORWEB.pdf
- White, B. R. (1993). *Helling v. McKinney*.
- Wilcox, S. (2007). Secondhand smoke signals from prison. *Michigan Law Review, 105*, 2081–2103.