

Smoking in Correctional Settings Worldwide: Prevalence, Bans, and Interventions

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Smoking tobacco contributes to 11.5% of deaths worldwide and, in some countries, more hospitalizations than alcohol and drugs combined. Globally in 2015, 25% of men and 5% of women smoked. In the United States, a higher proportion of people in prison smoke than do community-dwelling individuals. To determine smoking prevalence in prisons worldwide, we systematically reviewed the literature using Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines; we also examined whether prisons banned smoking or treated smokers. We searched databases for articles published between 2012 and 2016 and located 85 relevant articles with data representing 73.5% of all incarcerated persons from 50 countries. In 35 of 36 nations (97%) with published prevalence data, smoking for the incarcerated exceeded community rates 1.04- to 62.6-fold. Taking a conservative estimate of a 2-fold increase, we estimated that, globally, 14.5 million male and 26,000 female smokers pass through prisons annually. Prison authorities' responses include permitting, prohibiting, or treating tobacco use. Bans may temporarily improve health and reduce in-prison health care costs but have negligible effect after prison release. Evidence-based interventions for smoking cessation effective outside prisons are effective inside; effects persist after release. Because smoking prevalence is heightened in prisons, offering evidence-based interventions to nearly 15 million smokers passing through yearly would improve global health.

correctional; criminal justice; incarcerated; jail; prison; smoking; tobacco

INTRODUCTION

Globally in 2015, 1 in 4 men, and 1 in 19 women, smoked tobacco daily (1). Smoking tobacco is a major cause of preventable disease and death in most countries. Worldwide, 11.5% of deaths are attributable to smoking (1), and in Australia, for example, smoking contributes to more hospitalizations than alcohol and illicit drug use combined (2, 3). Smoking rates have fallen in many resource-rich countries since the end of the last century, due in part to policy changes such as tobacco tax increases; restrictions on tobacco advertising, promotion, and sponsorship; mass media campaigns; and pictorial health-warning labels (1, 4). Despite this overall decline in smoking prevalence, reductions have not been uniform, with smoking rates remaining higher among the poor, the less educated, and individuals with less access to prevention or treatment (5, 6). Internationally, a group that remains at greatest risk for smoking and its associated health consequences is people who have been imprisoned. In spite of the steady drop in smoking prevalence in countries such as the United States and Australia (1–4), people in carceral settings remain a population

with high rates of smoking and less access to treatment or prevention for smoking (7).

For decades, the United States has led the world with its imprisonment rate (8), and the subpopulations incarcerated at the highest rates are those most likely to smoke: men, younger persons, and the poor and less educated (9, 10). In 2004, before smoking bans became commonplace in US correctional facilities, the prevalence of smoking was 56.2% among all Americans who spent time in prison or jail, and/or experienced homelessness—a rate 2.7 times that for community-dwelling citizens (11). (This figure comes from an analysis based on National Health Interview Survey data; the analysis did not disaggregate the homeless and the incarcerated.) Whether this US pattern whereby smokers and those most likely to smoke are overrepresented in correctional populations is replicated internationally is unknown, although it is documented in a number of high-resource countries in a study that first appeared online in 2012 (12). If, worldwide, correctional settings hold a concentrated number of smokers, tobacco cessation efforts in these settings would likely be cost-effective. To understand the prevalence of smoking in carceral settings internationally,

a systematic review of the literature on smoking by confined persons is warranted.

In response to the high rates of smoking among individuals entering prisons and jails, many high-resource countries have instituted smoking bans in correctional facilities. The most common justification for smoking bans is to protect the health of persons who live and work in prisons by reducing smoking and exposure to secondhand smoke. Unwanted exposure to secondhand smoke was declared cruel and unusual punishment and outlawed by the US Supreme Court (13). Other justifications given by prison authorities for smoking bans are to reduce the cost of providing medical care, including hospitalizations, for prison employees and persons living in prisons. Smoking bans in prison are associated with an adjusted incidence rate ratio of 0.91 (95% confidence interval: 0.88, 0.95) in tobacco-related deaths and, once in place over 9 years, an adjusted cancer mortality rate ratio of 0.81 (95% confidence interval: 0.74, 0.90) (14). In addition, some prisons banned smoking to reduce “frills,” along with other amenities such as weight lifting equipment, musical instruments, and crafts programs (15). Last, smoking bans can reduce the risk of arson and burn injuries (16).

Opposition to bans has stemmed from many sources. Libertarians advocate for the right of incarcerated people to smoke if they choose and discuss the real or perceived likelihood that bans will lead to riots (17). As pointed out by Araromi (18), the European Prison Rules of 2006 state that “persons deprived of their liberty retain all rights that are not lawfully taken away by the decision sentencing them or remanding them in custody,” and the United Nations Human Rights Committee likewise stipulated that incarcerated persons retain rights except those unavailable by virtue of confinement. Many defend access to tobacco as an antidote to boredom and a stress reliever in the difficult circumstances of incarceration (19). Last, cigarettes have traditionally been used as a surrogate currency (20) because possessing money is outlawed in most prisons. Now that smoking bans have been imposed, commissary-bought packets of ramen noodles or stamps (21) have become the new currency in some systems.

Nonetheless, smoking bans without treatment of the underlying addiction to tobacco may have little effect on lifetime health. Little attention has been paid to postrelease rates of smoking and evidence that bans produce lasting change in smoking is sparse (22). Because measures to prevent disease need to be sustained to have an influence, health care planners should consider the effect of in-prison smoking bans on smoking after release from prison. One study of 129 persons who smoked before entry and were released from a county jail in Massachusetts showed that, without intervention other than a smoking ban, prevalence of smoking reverts quickly, with 97% of entrants resuming smoking within 6 months after release (23). There is evidence that counselling and behavioral interventions for smoking cessation in prisons show similar effects to those in community settings (24, 25) and there is support for the effectiveness of combined pharmacologic and psychological interventions during incarceration (26–28).

In this paper, we review systematically the prevalence of smoking in prison and corresponding community settings worldwide. We also review the implementation of bans on smoking in prison and interventions to reduce smoking during

and after incarceration. Finally, we discuss the short- and long-term effects of decreasing smoking in the custodial environment. We anticipated much of the literature would describe conditions in industrialized nations, because incarceration rates tend to be higher in more-affluent countries (8) and data collection in prisons may be greater in high-resource nations. We also anticipated that smoking bans in correctional settings would be shown to have short-term effects on reducing smoking and exposure to secondhand smoke and improving health indicators but little, if any, long-time effect on smoking rates after release.

METHODS

Using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (29), with modifications to incorporate previously conducted systematic reviews (30), we conducted a comprehensive systematic review of published and grey literature covering the period 2012–2016, to not overlap with a very comprehensive past review (12). We searched PubMed using the following search terms: (prison* OR jail* OR inmate OR inmates OR “correctional facility” OR incarcerated OR desmotic OR carceral OR “Prisons” [Mesh:NoExp]) AND (Smok* OR “tobacco use” OR Cigar* OR “smoking” [MeSH Terms] OR “Tobacco Products” [Mesh]). Other searches in PubMed included the tobacco terms and (1) “institutionalized” and (2) “compulsory.” We also searched Excerpta Medica dataBASE for articles using the aforementioned carceral and tobacco terms. We also searched Cumulative Index to Nursing and Allied Health Literature, Cochrane Database, and PsychInfo.

We noted that a number of published papers on tuberculosis in carceral settings included data on smoking. Mentions of tobacco in reports of tuberculosis may be because smokers have complaints similar to symptoms of tuberculosis (e.g., cough), smoking may predispose persons to acquisition of tuberculosis (e.g., via altered immunity), or smoking may simply be a confounder for heightened tuberculosis disease severity (e.g., both linked to poverty) (31). Because of this strong association, a second search of PubMed was made for articles on tuberculosis using the following terms: (prison* OR jail* OR inmate OR inmates OR “correctional facility” OR incarcerated OR desmotic OR carceral OR “Prisons” [Mesh:NoExp]) AND tuberculosis) limited to publication in 2012–2016. A search of these articles and the references of a systematic review found by the search (32) generated additional relevant articles not found without tuberculosis as a search term.

We searched African Journals Online with the search terms of prisons and smoking, jails and smoking, prisons and tobacco, jails and tobacco; its search engine did not support strategies with as many Boolean operators as PubMed. Similar search terms were used for *Literatura Latinoamericana y del Caribe en Ciencias de la Salud* and the Chinese National Knowledge Infrastructure. Last, we used snowball sampling by searching references of relevant articles and articles that cited articles with relevant data.

We searched for data on the World Health Organization website for data on smoking bans, specifically on a website listing bans in government settings (33). Comparison data for

the community came from the World Health Organization Tobacco Report 2015 (34), which contained data on smoking rates by 5-year intervals (e.g., 2005, 2010, 2015). Data for the year closest to the year for which correctional data are available are presented for comparison (e.g., World Health Organization data for 2 years before or 2 years after the year that the study collected data). Also, we consulted a study using Global Burden of Disease data (1).

Our multilingual research team was literate in English, French, Spanish, Portuguese, and Chinese and was able to search these sources in these languages to extract data from relevant literature. Reports using the tobacco and carceral keywords were first scanned by title, then abstract, then full text, if the extractor judged that the article would have unduplicated data on smoking prevalence. For articles with nonstandard keywords (e.g., tuberculosis), some articles were opened and

tables searched for the term “smok*” without reading the abstract first. Eligible articles were read by at least 2 readers. Because of multiple extractors, the numbers for abstracts scanned and articles read in entirety are estimates rather than exact numbers (noted as “approximately” in Figure 1). Data are presented for men and women and for adults older than age 15 years. When possible, we distinguished reports on prevalence and interventions for those awaiting trial versus sentenced populations, if the correctional system of a nation segregated the 2 groups. For prevalence data, if data collection spanned 2 calendar years, the data were attributed to the year that contained the majority of collection months. If the data gathered spanned multiple years, we attributed the data to the last year in the time period.

Because others have recently conducted excellent reviews of smoking bans and cessation interventions (12, 14, 22, 35),

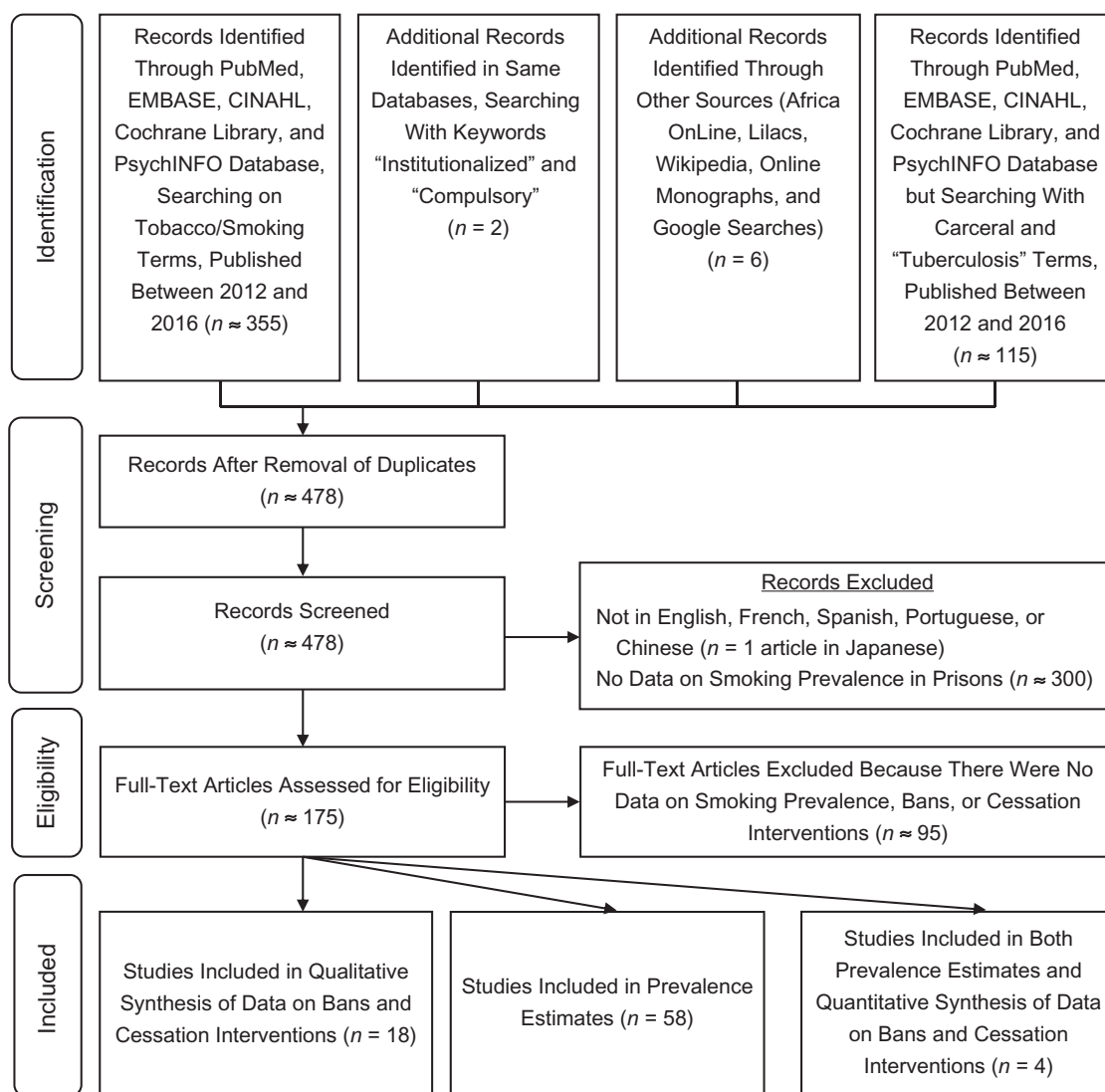


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses schema for article selection on smoking in prison, with data published in years 2012–2016. The following databases were searched: PubMed, Excerpta Medica dataBASE (Embase), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Cochrane Library, PsychINFO, Africa Journals Online, and Literatura Latinoamericana y del Caribe en Ciencias de la Salud (Lilacs). Because of multiple extractors, the numbers reported for abstracts scanned and articles read in their entirety are estimates rather than exact numbers; these values are shown as approximate.

we informally reviewed those reviews and checked whether additional studies could be added, rather than conducting original, exhaustive searches on these topics. From these, we gleaned which prison systems had bans and the effect of behavioral and pharmacologic interventions in prisons. We consulted the World Prison Brief (8) for data on prison system sizes.

ANALYSIS

We calculated the fold increase in smoking prevalence for prisons over that for the general population. We also estimated how many individuals enter and are released from prison, using data from the United Nations, which found that the average prison population turns over 3 times over the course of a year (36). From this point, we could estimate the number of individuals who would be affected if all countries had cessation interventions in their prisons.

RESULTS

Our initial search on tobacco-related terms in PubMed and Excerpta Medica dataBASE netted 285 articles published

between 2012 and 2016; all but 1 was in English, French, Spanish, or Portuguese. A search on Africa Journals Online netted an additional 3 articles; Cumulative Index to Nursing and Allied Health Literature and Literatura Latinoamericana y del Caribe en Ciencias de la Salud identified zero additional peer-reviewed articles. The Chinese National Knowledge Infrastructure netted 5 articles; subsequent searches on the Chinese database Wanfang added no extra articles (Figures 1 and 2). We found an additional 14 papers when we used tuberculosis search terms on PubMed. Most articles were from industrialized countries, especially the United States, Australia, and Brazil. No data were published on Caribbean nations, but personnel from Health Through Walls, a nongovernmental organization working primarily in prisons in Haiti, the Dominican Republic, Jamaica, and some African nations, note that habitual smoking is rare in prisons in low-resource countries (Dr. John P. May, Health Through the Walls, personal communication, 2017).

Prevalence

The prevalence of smoking is high among persons in prisons worldwide. For granular data on persons in US prisons,

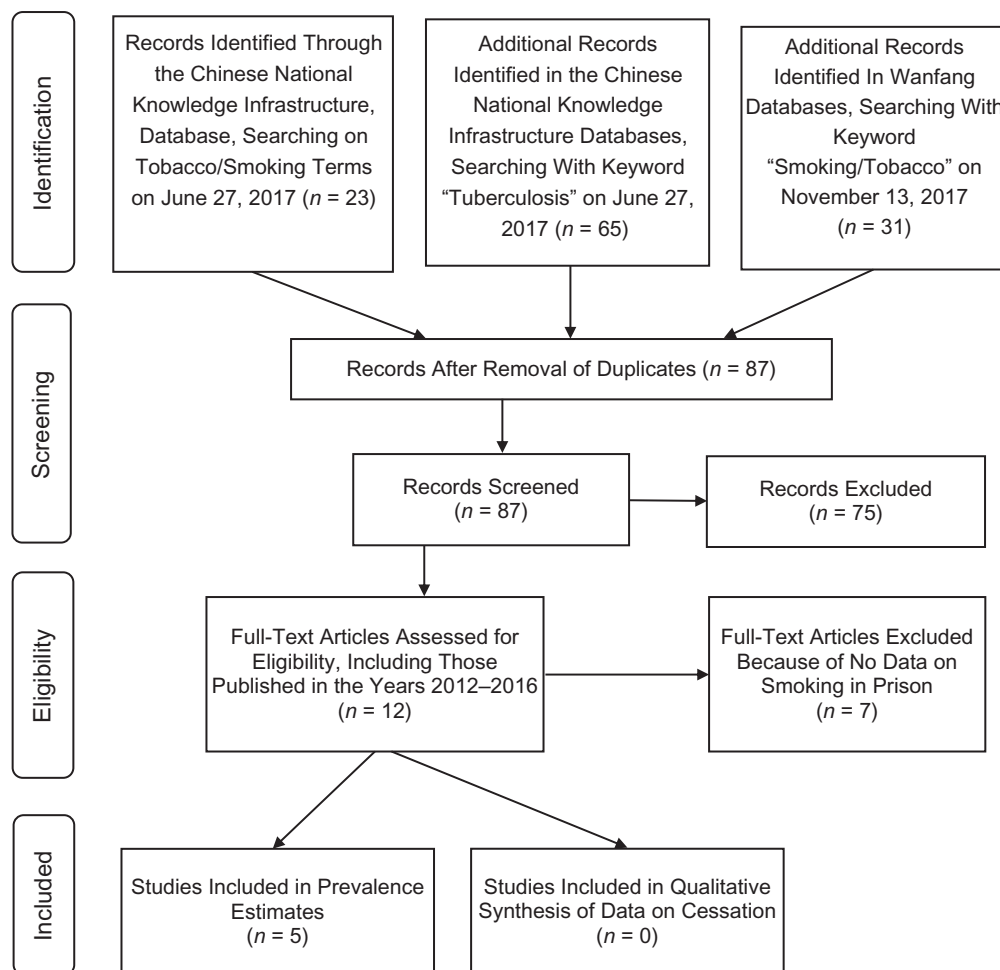


Figure 2. Preferred Reporting Items for Systematic Reviews and Meta-Analyses schema for article selection from the Chinese National Knowledge Infrastructure and Wanfang databases on smoking in prison, with data published in years 2012–2016.

and the general population and minority subpopulation in Australia facilities, see Web Appendices 1 and 2, Web Tables 1 and 2, and Web Figure 1 (available at <https://academic.oup.com/aje>). For details country by country on remaining nations, grouped by region, see Tables 1–4. A review chapter (12) published in 2012 also cited information on prevalence for Poland (81%) published in 2006 (39), and Lithuania (85.5%) in 2007 (40), 2 countries for which we found no more recent data. In all but 1 article, we found higher levels of smoking in prison compared with the community, ranging, for example, from more than 5-fold higher in Iran to just short of 2-fold higher in Uganda, South Africa, and Chile. In no country was smoking among the prison population consistently lower than in was at the community level. Although data were scarce, this pattern was repeated when the correctional population was analyzed by sex and smoking among men and women was compared with that occurring at community levels (e.g., among Greek men in prison vs. in the community, 75.5% vs. 55.7%, respectively; Pakistani women in prison vs. in the community, 60.9% vs. 3.7%, respectively). There was a trend of higher levels among men than among women in prison (e.g., men vs. women in Mexico prisons, 61.5% vs. 53.8%, respectively) that was repeated in the general population (Mexico community, men vs. women: 25.4% vs. 8.4%, respectively). In a single-prison study in China, most men who had ever smoked said they were former smokers.

The typical step-up, or fold increase in smoking prevalence for prisons relative to the general community ranged from 1.7 to more than 8-fold overall, and 1.3- to 7.3-fold for men and 1.7- to 62.6-fold for women. In prisons where smoking was not banned, prevalence was observed just once to be lower than that in the country as a whole (see Tables 1–4). We can make a prediction of how many smokers go through prison if we multiply the typical step-up by the percentage of smokers in the general population, and then multiply the product by the number of persons imprisoned worldwide. Conservatively, we estimate that overall the smoking prevalence doubles from community to prison. We know that 25% of men and 5% of women in the world smoke (1). By multiplication, then at least 50% of men and 10% of women in carceral settings are smokers. If the daily census of persons in prison is about 10 million ($n = 9,673,000$ men and $n = 87,000$ women) (8) and the typical yearly churn through a prison, or “institution throughput,” is 3 times the daily count (38), approximately 30 million persons overall ($n = 29,020,000$ men and $n = 262,000$ women) move through the criminal justice systems of the world each year, of whom 14,510,000 men and 26,000 women are smokers.

Bans

The Web Appendices 1 and 2 illustrate the effect of bans in the United States and Australia, respectively. In the United States, bans in the Federal Bureau of Prisons and most state prisons have meant that nearly all the 1.6 million persons serving felony sentences are prohibited from smoking. This has resulted in health improvements for prison health services, as analyzed by Binswanger et al. (14) and shown in Web Appendix 1. Most jails in the United States also operate as smoke-free facilities (35). The cost savings of bans there have not

been systematically studied (35). Web Table 3 shows that bans are sporadic in Chinese prisons. Web Table 4 provides data on the bans on smoking for several other countries.

Interventions

Results of interventions published between 2012 and 2016 are shown in Table 5. Most persons imprisoned report that they want to quit but need help to do so (36, 41). Health education alone does not appear to help (42), nor does employing a “criminal justice tobacco control coordinator” (43). A randomized trial in Rhode Island demonstrated that in-prison delivery of motivational interviewing and cognitive behavioral therapy resulted in a significant improvement in smoking cessation that persisted for at least 6 months after release (24, 44). In an Australian prison trial, quit rates with cognitive behavioral therapy were similar to results achieved in the community, and adding a tricyclic antidepressant did not enhance quit rates (28). Even with published evidence that behavioral interventions work to reduce smoking in prison, correctional systems have been slow to adopt this preventive health tool. About half of the studies examined nicotine replacement therapy (Table 5).

Potential effect, globally, of decreasing smoking

Worldwide, with about 15 million smokers in prison at least part of the year and 5 million confined at any given point in time, cessation interventions delivered in the correctional setting have the potential to reach many bypassed by traditional outreach. Behavioral interventions in prisons are replicable even in middle-income countries (45) and, if results of replication mirror results in initial studies, about 10% of participants may remain abstinent after release from prison. With 20 million individuals being released and returned to their communities, half of whom are smokers, in-prison programs could globally result in as many as 2 million fewer smokers resettling in communities around the world.

DISCUSSION

We systematically reviewed the data on the level of smoking in prisons and corresponding community settings, examined the implementation of bans on smoking in prison, and reported on postrelease relapse to smoking. In addition, we studied the range of options for decreasing smoking in the custodial environment and reviewed the health effects of bans and interventions. By including “tuberculosis” as a search term, our literature search yielded more articles than in previous reviews. By reviewing several non-US databases, we report on a greater portion of the world’s literature on smoking in prisons. We calculated how many people would stop smoking if every correctional facility in the world offered behavioral, pharmacologic, or a combination of interventions for smoking cessation.

We have findings from 50 countries, which represent 73.5% of all incarcerated persons in the world (8). In 35 of 36 of nations (97%) with published prevalence data, smoking by incarcerated people exceeded community rates 1.04- to 62.6-fold. Only in Chinese men’s prisons were rates not consistently

Table 1. Prevalence of Smoking in General Population and in Prison by Sex, Europe, 2012–2016

First Author, Year (Reference No.)	Location	Study Population	Year Data Collected	In Prison, %	General Population, ^a %	Fold Increase	No. of Incarcerated Study Subjects	Prison Population ^b
<i>Mixed Sex Studies^c</i>								
Jaka, 2014 (51)	Albania	Study of health status	2013	59.1	29.3	2.02	401	5,201
Jacomet, 2016 (52)	France	Surveillance for infectious disease	2013	83.8	24.7	3.39	357	72,796
Ceelen, 2012 (53)	Netherlands	Study of health history	2009	75.6	26.7	2.85	264	15,235
Turan, 2015 (54)	Turkey	Persons with COPD	2013	68.7	25.9 ^d	2.65	109	158,837
Carnie, 2016 (41)	Scotland	9 Scottish prisons	2015	72.0	18.7 ^e	3.85	Not specified	7,611
<i>Studies of Men</i>								
Singleton, 2003 (55); Jayes, 2016 (56)	England	4 prisons with smoke-free wings	1997	85.0 of remand of sentenced	23 ^e	3.39	Not specified	61,252
Chariot, 2014 (57)	France	Fitness assessment while incarcerated	2012	70.3 ^f	30.4 ^g	2.30	10,726	80,489
Makris, 2012 (27)	Greece	204 men in prison	2010	75.5	55.7 ^d	1.36	204	10,810
McCaffrey, 2012 (58)	Ireland	General health care study of the Irish prison population	2000	91.0 ^f	32.3 ^e	2.82	Not specified	2,864
Mannocci, 2015 (59)	Italy	Study of health status while incarcerated	2011	69.7	29.0	2.40	121	64,966
Pinto, 2015 (60)	Portugal	Youth in detention (ages 13–19 years)	Not specified	40.0 current; 90.0 “early initiation”	28.8	1.39	30	13,065
Vera-Remartínez, 2014 (61)	Spain	Study in prison ($n = 1,170$)	2013	71.0	29.9 ^g	2.37	1,022	70,692
Ritter, 2013 (62)	Switzerland	Switzerland	2010	84.0	25.5	3.29	Not specified	5,834
Winetsky, 2014 (63)	Tajikistan	TB	2010	38.6	30.0	1.29	1,317	9,168
<i>Studies of Women</i>								
Singleton, 2003 (55); Jayes 2016 (56)	England	Remand and sentenced persons in prison	1997	83.0 of remand in prison	20.1 ^e	4.03	Not specified	3,350
Sahajian, 2012 (64)	France	Detained women	2008	37.5 ^f	22.6 ^g	1.66	354	1,828
Mir, 2015 (65)	Germany	Women entrants	2012	80.7	24.4		150	
McCaffrey, 2012 (58)	Ireland	General health care study of the Irish prison population	2000	100 ^f	29.6 ^e	3.38	Not specified	84
Vera-Remartínez, 2013 (61)	Spain	Study in prison ($n = 1,170$)	2013	58.2 ^f	22.3 ^g	2.61	55	4,521

Abbreviations: COPD, chronic obstructive pulmonary disease; TB, tuberculosis.

^a Data on general population from the World Health Organization (34), unless otherwise stated.

^b Data from World Prison Brief (8).

^c There is a consistent pattern in which the prevalence of smoking is nearly always very high among studies of prison populations of mixed sex, ranging from 59.1% in Albania to 68.7% in Turkey to greater than 70% in the Netherlands and Greece and greater than 80% in England and Switzerland.

^d The prevalence of smoking in the general community ranges from 25.9% in Turkey to 55.7% in Greece.

^e Data from Ng (46).

^f Where comparable data exist, men in prison have higher levels of smoking than women, as in France (70.3% vs. 37.5%) and Spain (71.0% vs. 58.2%). In Ireland, however, both sexes have very high levels of smoking: 91% for men and 100% for women in the prison.

^g This trend of higher levels among men mirrors that in the general populations in France (30.4% vs. 22.6%) and Spain (29.9% vs. 22.3%).

Table 2. Prevalence of Smoking in General Population and in Prison by Sex, Asia and Pacific Island, 2012–2016

First Author, Year (Reference No.)	Location	Study Population	Year Data Collected	In Prison, %	General Population, ^a %	Fold Increase	No. of Incarcerated Study Subjects	Prison Population ^b
<i>Mixed Sex Studies</i>								
Chen, 2014 (66)	China	Cases of xerophthalmia	2013	74.7	26.3	2.84	79	1,657,812
Tiwari, 2014 (67)	India	5 central jails of Chhattisgarh State in a sample of 506 persons in prison	2013	56.2	11.0	5.11	506	418,536
Al-Darraj, 2014 (68)	Malaysia	TB study, prison of 340	2010	98.2 ^c	23.7 ^c	4.14	286	38,387
Margolis, 2013 (69)	Malaysia	TB study, prison of 288	2011	98.1 with prior history	23.7	4.14	266	36,608
Muir, 2016 (70)	New Zealand	TB and LTBI	2011	60–80	17.9 ^d	3.35	Not specified	8,604
Soomro, 2016 (71)	Pakistan ^e	300 persons in prison	2015	62.0	21.6	2.87	300	79,700
Morishita, 2017 (72)	Philippines	TB	2015	82.4 ^c	25.3 ^c	3.26	6,133	120,076
<i>Studies in Men</i>								
Liu, 2015 (73)	China, Xi'an city	Study of health status	2013–2014	63.3	49.3	1.28	627	1,565,400
Wang, 2016 (74)	China, Nantong, Jiangsu province;	Smoking status before prison: Smoker Quit smoking	2014	27.7 52.8	49.3	0.56 ^f	2,205	1,565,400
Shi, 2015 (75)	China, Hongzehu, Jiangsu province	Cases of hypertension	2014	65.3	49.3	1.32	300	1,565,400
Torwane, 2013 (76)	India	Half with psychiatric issues, half without	2013	77.0 ^c	11.0 ^c	7.00	244	353,961
Naik, 2014 (22)	India	1,600 convicted persons in prison	Not given	78.3 ^c	11.0 ^c	7.27	1,600	353,961
Chen, 2012 (77)	Taiwan	Smoking before prisons	2000	90.7	33.5 ^d	2.72	589	51,689
Li, 2013 (78)	Taiwan	Controls in cancer study	2008	89.1	33.5 ^d	2.61	709	57,642
<i>Studies in Women</i>								
Khan, 2012 (79)	Pakistan	Study of depression in women's prison of 140	2008	60.9	3.7	16.49	64	931
Liu, 2015 (80)	China, city of Xi'an	Study of health status	2013–2014	30.6	2.0	15.3	500	107,131

Abbreviations: LTBI, latent tuberculosis infection; TB, tuberculosis.

^a Data on general population from the World Health Organization (34), unless otherwise stated.

^b Data from World Prison Brief data (8).

^c In this region, the prevalence of smoking among prison population was very high in comparison with the general population in Malaysia (98.2% vs. 23.7%) and Australia (74% vs. 14.3%), Indian men (>75% vs. 11%), and Filipinos in the context of a TB study (82.4% vs. 25.3%).

^d Data from Ng (46).

^e Pakistan tested levels of smoking among particular groups (52% of murderers and 72% of thieves) and found it much higher than the general population (21.2%).

^f Only among Chinese men, who in the general population have some of the highest rates of smoking in the world, was smoking in prison not consistently higher.

Table 3. Prevalence of Smoking in General Population and in Prison by Sex, Mid-Eastern and African Countries, 2012–2016

First Author, Year (Reference No.)	Location	Study Population	Year Data Collected	In Prison, %	General Population, ^a %	Fold Increase	No. Incarcerated Study Subjects	Prison Population ^b
<i>Mixed Sex Studies</i>								
Kwabla, 2015 (81)	Ghana	TB study	2014	43.7	6.1	7.16	161	13,164
Mamani, 2016 (82)	Iran	LTBI study	2013	81.9 ^c	10.9 ^c	7.53	1,208	226,220
Khajedaluae, 2016 (83)	Iran	Study participants with HTLV-I, HBV, HCV, and KSHV	2008	70.2	11.8	5.95	1,114	168,516
Mor, 2015 (84)	Israel, Eritrea, Sudan, Ethiopia	Undocumented, detained migrants with radiograph suggestive of TB	2009	48.4	19.9 ^d	2.43	62	20,164
Kinyanjui, 2013 (85)	Kenya	Prison population in Kenya	2011	32.7 (14.0% in past week)	13.5	1.04; 2.42	395	52,000
Mnisi, 2013 (86)	South Africa	TB	2010	59.9	19.4	3.09	202	163,312
Ekouevi, 2013 (87)	Togo	Study of HIV seroprevalence in the prison population	2011	31.9	3.9 ^d	8.18	1,342	4,060
Owokuhausa, 2014 (88)	Uganda	TB study	2012	19.7 ^e	10.1 ^e	1.95	677	34,940
<i>Studies of Men</i>								
Fuge, 2016 (89)	Ethiopia	Persons screened for pulmonary TB	2013	54.9	8.1	6.78	164	100,572
Akaji, 2013 (20)	Nigeria	Study of tobacco use	2010	53.6 ^e	15.0 ^e	3.57	224	45,689
Jaquet, 2016 (90)	Senegal	Men incarcerated in Lome, Togo; and in Dakar, Senegal	2014	64.2	23.5	2.73	333	8,355
Telisinghe, 2014 (91)	South Africa	TB study	2010	Current smokers: 57.9 Former smokers: 19.4	32.0	1.81	981	159,618
Nyasulu, 2015 (92)	South Africa	Those treated for TB	2010	Current smokers: 48.9 Former smokers: 11	32.0	1.53	1,140	159,618
Jaquet, 2016 (90)	Togo	Men incarcerated in Lome, Togo; and in Dakar, Senegal	2013	29.4	13.8 ^d	3.57	347	4,372
<i>Studies of Women</i>								
Abera, 2016 (93)	Ethiopia	738 persons in prison in 9 major prison setups in Tigray region	2013	31.3	0.5	62.60	16	3,630
Fageeh, 2014 (94)	Saudi Arabia	Saudi Arabia women at Briman Prison, Jedda, <i>n</i> = 300	2012	18.6 ^c	2.8 ^c	6.64	204	2,793

Abbreviations: HBV, hepatitis B virus; HCV, hepatitis C virus; HIV, human immunodeficiency virus; HTLV, human T-cell leukemia virus type I; KSHV, Kaposi sarcoma–associated herpes virus; LTBI, latent tuberculosis infection; TB, tuberculosis.

^a Data on General Population from the World Health Organization (34), unless otherwise stated.

^b Data from World Prison Brief data (8).

^c In the Middle East, few data were located. Iran and Saudi Arabia had a higher level of smoking among general (94%) and female carceral (18.6%) populations than the general population (10.9%) and general female population (2.8%), respectively.

^d Data from Ng (46).

^e In Africa, we located data for 6 countries. Higher levels were found among mixed sex prison studies in Nigeria (53.6%) and Uganda (19.7%) than in the general community (15% and 10.1%) respectively.

Table 4. Prevalence of Smoking in General Population and in Prison by Sex, the Americas, 2012–2016

First Author, Year (Reference No.)	Location	Study Population	Year Data Collected	In Prison, %	General Population, ^a %	Fold Increase	No. of Incarcerated Study Subjects	Prison Population ^b
<i>Mixed Sex Studies</i>								
Carbone, 2015 (95)	Brazil	TB study, in a prison	2013	54.8 ^c	15.2	3.61	3,380	622,202
Nogueira, 2012 (96)	Brazil	TB study, 1 jail, 1 prison	2008	61.2 ^c	17.6 ^c	3.48	2,237	451,429
Valença, 2015 (97)	Brazil	TB study, 1 prison	2012–2013	68.4 ^c	15.2	4.5	301	622,202
Aguilera, 2016 (98)	Chile	TB study	2012–2013	68.5	40.1	1.71	336	45,501
<i>Studies of Men</i>								
Estevan, 2013 (99)	Brazil	Study of TB rates	2010	55.4 ^d	22.1 ^d	2.51	249	461,444
Bautista-Arredondo, 2015 (100)	Mexico	Prison population	2010	61.5	25.4	2.42	1,934	209,188
Fernandez-Prada, 2013 (101)	Mexico	TB in HIV+ prison population	2010	85.2	Unknown tobacco prevalence in HIV+ men		27	209,188
<i>Studies of Women</i>								
Zonta, 2012 (102)	Brazil	Cervical cancer in prison of 409 women	2006	66.7 ^d	15.5 ^d	4.30	27	20,264
dos Anjos Sde, 2013 (103)	Brazil	Cervical cancer	2009	44.5 ^d	13.3 ^d	3.35	36	34,807
Bautista-Arredondo, 2015 (100)	Mexico	17,000 persons in prison at 4 Mexico City prisons	2010	53.8	8.4	6.40	520	9,839

Abbreviations: HIV, human immunodeficiency virus; TB, tuberculosis.

^a Data on general population from the World Health Organization (34), unless otherwise stated.

^b Data from World Prison Brief data (8).

^c Extensive data were located for Brazil, which consistently showed higher levels among general prison populations (54.8%, 61.2%, 68.4%) than general populations (17.6%).

^d Brazilian data confirmed higher levels among female (66.7% and 44.5%) and male (55%) incarcerated subjects than females (15.5% and 13.3) and males in the community (22.1%).

Table 5. Summary of Smoking Cessation Interventions Published Between 2012 and 2016^a

First Author, Year (Reference No.)	Intervention	Trial Design	Cessation Measurement	Timing of Measurement	Strength of Trial ^a	Outcome: Change in Behavior
Akbar, 2012 (42)	Oral health education	Pre/Post	Self-report	In facility	Weak	No change
Etter, 2012 (104)	Counseling, NRT	Pre/Post	Self-report	In facility	Weak	No change
Makris, 2012 (27)	Varenicline + counseling	Pre/Post	Self-report plus biological	In facility	Weak	30.7% abstinent at 3 months; 20.2% at 1 year
Clarke, 2013 (25), 2011 (44), 2015 (105)	CBT, MI	RCT	Biological	After release	Strong	7-day point abstinence, 3-week follow-up, 35% (intervention) and 7% (control); 3-month follow-up, 12% (intervention) and 2% (control).
Richmond, 2013 (28)	CBT + NRT, with nortriptyline or placebo	RCT	Self-report plus biological	In facility	Strong	No effect of added nortriptyline. Continuous abstinence at 3 months (23.8% treatment vs. 16.4% control); 6 months (17.5% vs. 12.3%); 12 months (11.7% vs. 11.9%)
Naik, 2014 (24)	MI	RCT	Self-report plus biological	In facility	Moderate	At 6 months, 16% in intervention stopped smoking, reduction in CO level
Jalali, 2015 (106)	MI + NRT	RCT	Self-report plus biological	In facility	Strong	90-day follow-up. Significant reductions in CO, CPD, and Fagerstrom score in MI only and MI+NRT groups between pre- and post-tests and pre-test and follow-up. No differences between post-test and follow-up.
Turan, 2016 (107)	NRT, varenicline, bupropion	Pre/Post	Self-report	In facility	Weak	30-day follow-up, 22.5% reported some reduction in smoking.

Abbreviations: CBT, cognitive-based therapy; CO, carbon monoxide; CPD, cigarettes per day; MI, motivational interviewing; NRT, nicotine replacement therapy; Pre/Post, preintervention and postintervention; RCT, randomized clinical trial.

^a Adapted from de Andrade and Kinner (37), with permission from BMJ Publishing Group Ltd. Copyright 2017.

higher, but China has been experiencing a tremendous increase in smoking in the general male population since 2006 (46). In a study of Chinese citizens entering a methadone maintenance program after failing treatment in compulsory drug rehabilitation centers, researchers reported 99% had ever smoked and 89% currently used tobacco (47).

About one-fifth of the data on smoking rates came from tuberculosis studies in which smoking prevalence was an ancillary finding: Smoking likely heightens risk for tuberculosis disease (48, 49). Public health officials understand how prisons serve as incubators for tuberculosis and how disease control depends on focusing national control efforts in prisons. The overall health of individuals in prison, including the presence of noncommunicable disease (e.g., cardiovascular disease; cancer associated with smoking), may be less of a priority for these officials and are not the prime reason for these prison studies.

Overall, we found high levels of smoking among people who entered or were held in prisons, and those levels were higher than in the corresponding communities. This finding is to be expected given the overrepresentation in prisons and jails of vulnerable groups who have high levels of drug use in general and of smoking in particular. In many countries, incarcerated individuals could be missed by traditional public health interventions to reduce smoking or have less access to smoking cessation interventions. This marginalized group could constitute a hidden population difficult to access for prevention and treatment. These findings underscore the critical importance of evidence-based treatment for substance use disorders, including smoking cessation, in prison settings. With an estimated 30 million people passing through prisons globally each year (38), failure to bring evidence-based treatment to scale in prison settings, particularly those where the prevalence of smoking is high, will have a substantial and measurable negative effect on public health.

Nevertheless, instead of providing treatment, the more common response by prison authorities has been the introduction of bans on smoking. Typically, these have been implemented in stages; for example, bans initially may be applied to the incarcerated population and indoor spaces only and then expanded to include outdoor spaces and prison staff. It appears that only a complete ban throughout the correctional facility, enforced outdoors and indoors, for both staff and the people incarcerated, extinguishes smoking in the facility. However, there is no evidence that suppressing smoking during incarceration translates into smoking cessation after release. Indeed, in studies that examined smoking rates after release, researchers showed that in the absence of an intervention other than a smoking ban, smoking rapidly reverted to baseline levels after release (23, 50).

Smoking cessation interventions are effective in reducing smoking during incarceration (Table 5). Smoking cessation interventions in US facilities, beyond just imposing bans, date back over a decade, when, in a randomized clinical trial of a behavioral intervention and nicotine replacement therapy, tobacco cessation rates were comparable to community rates (5, 26). Nicotine replacement therapy is an effective intervention in the community, in prisons where cigarettes are permitted or illicitly available (26), or short-term in a jail with or without a smoking ban. Regrettably, nicotine replacement therapy products are not routinely available in prisons and when

they are available for sale in prison commissaries, they are often exorbitantly priced (35).

If, indeed, smoking rates are elevated in prisons, then public health services would be wise to introduce tobacco cessation interventions in the prison setting. Treatment that has worked in community settings has been found to be effective in the setting of incarceration, allaying fears that interventions in prison would have to be fundamentally different. The question seems to be one of political will and feasibility to introduce smoking interventions into correctional settings. In a recent trial in the middle-income country of Nigeria, conducted more recently than during our study period of 2012–2016, researchers demonstrated that implementing a group-level intervention of cognitive behavioral therapy was feasible in its prison system (45), suggesting that feasibility concerns can be addressed in other countries and settings.

Limitations

Some studies had very small samples and some data were extracted from studies where smoking was not the primary outcome. Thus, the data presented cannot be assumed to be representative of each country's prison population. Nevertheless, this is the first time, to our knowledge, that such an extensive review of smoking prevalence in prison has been undertaken. Moreover, the elevated prevalence of smoking among persons in prison highlights the need for more research in this area. There were insufficient data to determine a pattern of decreased smoking prevalence in those countries with prison smoking bans. Tracking changes in smoking prevalence over time, especially among prison entrants, will be especially important in the jurisdictions that have implemented smoking bans. Last, we did not assign a point person to record the screening process, which led to an inability to create a precise Preferred Reporting Items for Systematic Reviews and Meta-Analyses diagram.

Conclusions

More work is required to identify and overcome barriers to providing treatment in prison. It was beyond the scope of this review to consider what effects the bans had on the prevalence of smoking after release, but it would appear that virtually all formerly incarcerated persons resume smoking once released. Even though smoking bans provide a temporary break from smoking and exposure to secondhand smoke, they appear to be insufficient on their own to increase the proportion of former smokers after release. The challenge is to promote long-term cessation during incarceration and prevention of relapse after release into the community or at other facilities (e.g., halfway houses) that may not have smoking bans. Given efforts to promote reductions in the prevalence of smoking worldwide, neglecting the vulnerable populations hidden in prisons is an injustice and one that is likely to perpetuate health disparities.

Areas for future research include the assessment of the health and survival benefits of introducing smoking bans in prisons, for persons who dwell in prisons and for staff who work in those environments. The postrelease effects of evidence-based interventions for smoking cessation in prison settings worldwide need to be measured. The costs of tobacco bans are likely negligible and, although cost analysis research is lacking, the

cost of delivering smoking cessation interventions is likely to be modest, relative to their benefit. Thorough cost analysis would inform policy makers how feasible delivering effective interventions can be (35).

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