**Use of prescribed smoking cessation pharmacotherapy following release from prison: A
prospective data linkage study**

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Abstract

Background: A significant proportion of people who cycle through prisons express a desire to quit smoking, yet smoking rates in this population are 2-4 times higher than in the general community. Smoking cessation pharmacotherapy (SCP) is an important component of evidence-based cessation support, yet no studies have examined use of this pharmacotherapy after release from prison.

Methods: We linked data from a survey of 971 smokers who were within 8 weeks of release from prison in Queensland, Australia with federal Pharmaceutical Benefits Scheme (PBS) records for the two years after release, to identify subsidised use of SCP (varenicline, bupropion, and nicotine patches). We used Cox proportional hazards regression to identify independent predictors of SCP use.

Findings: According to PBS data 86 participants (8.9%) accessed SCP in the two years following release from prison. Participants who were aged 25 years or older (hazard ratio (HR) 2.51, 95%CI 1.19 to 5.31), employed before prison (HR 1.93, 95%CI 1.14 to 3.28), highly nicotine dependent at baseline (HR 2.21, 95%CI 1.23 to 3.97), and using non-psychotropic medications in prison (HR 2.29, 95%CI 1.24 to 4.22) were more likely to use subsidised SCP during follow-up.

Conclusion: Despite a very high rate of tobacco use among people cycling through prisons and the very low cost of (subsidised) SCP in Australia, few ex-prisoners obtain pharmaceutical assistance with quitting smoking. Policy attention needs to focus on supporting former prisoners to access SCP, to reduce the high rate of tobacco-related morbidity and mortality in this profoundly marginalised population.

BACKGROUND

Prisoners smoke tobacco at a rate of between two and four times the non-incarcerated population, [1–4] yet the majority report a desire to quit. [2,5] These high levels of tobacco use exacerbate prisoners' already increased age-adjusted mortality and morbidity, [2,6] potentiate symptoms of mental disorder, [7,8] and compound financial disadvantage.[5]

In an attempt to reduce tobacco-related harms in this population, tobacco smoking has been fully or partially banned in correctional facilities in some countries. [9–13] While these bans may result in some health benefits, [9] smoking abstinence is often temporary, with the majority relapsing on the day of release.[14,15] The time following release from prison is marked by a decline in physical [6,16–20] and mental [21,22] health for many ex-prisoners. Interventions to promote long-term smoking cessation after release from prison are urgently required.

Smoking cessation pharmacotherapy (SCP) including nicotine replacement therapy (NRT) [23,24] and prescription-only medications varenicline and bupropion [25–27] are recognised for their effectiveness in assisting with smoking cessation. A recent review confirmed the effectiveness of pharmacotherapy in helping prisoners maintain smoking cessation. [28] In Australia, although NRT is available for over-the-counter purchase, nicotine patches, bupropion and varenicline are available by prescription through the Pharmaceutical Benefits Scheme (PBS), which provides medications to Australians at a federal government-subsidised price, with further discounts to concessional users on low incomes. [29,30] The Australian health care system provides universal free or subsidised health care services to its citizens, [31] and rates favourably in terms of efficiency, quality, and access to care and medication compared to many other developed countries. [32,33] Although prisoners in Australia are unable to access PBS-subsidised medications, [34] once they are released from prison these medications are typically available at very low cost; for

example, concessional PBS users (including most former prisoners) can access varenicline for AUD\$6.20, compared to AUD\$38.30 for other PBS users, and AUD\$109.55 for non-PBS users.[30,35]

Only one study has examined predictors of NRT adherence in prison, with identified predictors being greater prior daily smoking level and more previous quit attempts. [36] No studies have measured use of SCP *after* release from prison, such that neither the uptake nor the characteristics of those who access SCP after release from prison are known. In a large cohort of adult smokers released from prison, the aim of this study was to document the incidence and identify predictors of prescribed nicotine patch, varenicline and bupropion use.

METHOD

Study Overview

This paper involves secondary analysis of data from a randomised controlled trial of the *Passports* intervention, designed to increase access to health care in adults released from prisons in Queensland, Australia. [37,38] Baseline data were collected in seven prisons between August 2008 and July 2010 from adults who expected to be released within the next six weeks. Participant identities were linked prospectively with correctional, health and mortality records for two years after release. Reincarceration data from Queensland Corrective Services (QCS) were linked deterministically based on a unique prisoner identification number. PBS records for the cohort were obtained through probabilistic data linkage based on name, sex, date of birth, and any aliases. We identified deaths in the sample through probabilistic linkage with the National Death Index.

Sample

From an initial sample of 1,325 participants we removed 288 non-smokers (measured by self-reported smoking status at baseline), 65 inmates not released within 8 weeks of

baseline interview, and 1 participant for whom data could not be linked. The sample for analysis was 971 participants who were released from prison during the study.

Measures

Outcome variable – SCP access

We searched PBS claims data for first dispensing of SCP within two years of release from prison. SCP options available on the PBS include nicotine patches (ATC code N07BA01), varenicline (ATC code N07BA03), and bupropion (ATC code N06AX12). [30]

Baseline measures

We examined potential predictors of SCP uptake across six domains: socio-demographic, criminal justice, substance abuse, mental health, physical health, and social/reintegration support. An additional variable controlled for the impact of the *Passports* intervention. Exposed and unexposed categories for each variable, and the data source, are described in the Supplementary Table.

Statistical Analyses

We performed univariate and multivariate Cox regression analyses with time to first SCP access as the outcome. The period of observation for each participant spanned from date of release from prison until first nicotine patch, varenicline, or bupropion supply, death, or two years after release. To account for episodes of reincarceration during follow-up (where PBS subsidies are unavailable), we removed days in prison from time at risk. Analyses were performed using Stata version 13.1.

Ethics

Ethical clearance was provided by the University of Queensland's Behavioural and Social Sciences Ethical Review Committee, Queensland Health Human Research Ethics Committee, and the Australian Institute of Health and Welfare Ethics Committee. Data linkage to the PBS was approved by the Commonwealth Department of Human Services.

RESULTS

A total of 86 (8.9%) participants were supplied PBS-subsidised SCP during a median of 22.1 months (IQR 14.8 months to 24 months) of community follow-up. This equates to a supply rate of 5.7 per 100 person-years. SCP types for first supply post-release included varenicline (n=78), nicotine patches (n=5) and bupropion (n=3). Table 1 shows the percentage of participants who accessed SCP within the follow-up period according to baseline characteristics, and the unadjusted and adjusted hazard of SCP access according to baseline characteristics. The Passports intervention had no effect on SCP access ($p>0.05$), and so was excluded from the adjusted model to preserve statistical power. In the adjusted model, variables significantly associated with SCP supply included being aged 25 years or older (see Figure 1), being employed before prison, being highly nicotine dependent at baseline, and using non-CNS medications at baseline.

Table 1: Descriptive statistics, and unadjusted and adjusted hazard of SCP access according to baseline characteristics (N=971)

Characteristic (exposed)	Number (%) with characteristic	Number (%) accessed NRT		HR (95%CI)	AHR (95%CI)
		Among those exposed	Among those non- exposed		
<i>Socio-demographic</i>					
Age ≥25 years	704 (72.5%)	77 (10.9%)	9 (3.4%)	3.04 (1.53, 6.07)**	2.51 (1.19, 5.31)*
Female	221 (22.8%)	20 (9.1%)	66 (8.8%)	0.91 (0.55, 1.50)	0.76 (0.40, 1.42)
Not Indigenous	707 (72.8%)	76 (10.8%)	10 (3.8%)	2.75 (1.42, 5.32)**	1.89 (0.89, 4.00)
≥10 years schooling	526 (54.3%)	56 (10.7%)	30 (6.8%)	1.44 (0.92, 2.24)	1.17 (0.71, 1.95)
Dependent children	348 (35.8%)	33 (9.5%)	53 (8.5%)	1.10 (0.71, 1.70)	1.00 (0.60, 1.67)
Not married/defacto	632 (65.1%)	55 (8.7%)	31 (9.1%)	0.98 (0.63, 1.53)	0.86 (0.51, 1.45)
Housing instability ^a	757 (78.0%)	69 (9.1%)	17 (7.9%)	1.09 (0.64, 1.85)	0.89 (0.50, 1.59)
Employed ^b	421 (43.4%)	52 (12.4%)	34 (6.2%)	1.96 (1.27, 3.02)**	1.93 (1.14, 3.28)*
Living above poverty line ^c	496 (51.2%)	49 (9.9%)	37 (7.8%)	1.30 (0.85, 2.00)	0.88 (0.53, 1.46)
<i>Criminal justice</i>					
No prior adult incarceration	266 (27.5%)	33 (12.4%)	53 (7.5%)	1.45 (0.94, 2.24)	1.19 (0.70, 2.02)
Incarceration ≥6 months	414 (42.6%)	34 (8.2%)	52 (9.3%)	0.96 (0.62, 1.48)	0.80 (0.49, 1.31)
Drug-related sentence	332 (34.3%)	27 (8.1%)	59 (9.3%)	0.95 (0.60, 1.49)	1.38 (0.76, 2.40)
<i>Substance use</i>					
Very high nicotine dependence (FTND)	137 (14.1%)	16 (11.7%)	71 (8.5%)	1.43 (0.83, 2.45)	2.21 (1.23, 3.97)**

High risk drinking (AUDIT)	383 (40.4%)	31 (8.1%)	55 (9.7%)	0.86 (0.55, 1.33)	1.26 (0.76, 2.09)
Risky cannabis use (ASSIST)	516 (53.2%)	31 (6.0%)	55 (12.1%)	0.51 (0.33, 0.79)**	0.60 (0.36, 1.00)
Risky amphetamine use (ASSIST)	423 (43.7%)	26 (6.2%)	60 (11.0%)	0.59 (0.37, 0.93)*	0.59 (0.33, 1.04)
Risky opioid use (ASSIST)	244 (25.1%)	22 (9.0%)	64 (8.8%)	1.16 (0.71, 1.88)	1.28 (0.71, 2.31)
<i>Mental health</i>					
High/very high psychological distress (K10)	261 (27.0%)	26 (10.0%)	60 (8.5%)	1.17 (0.74, 1.85)	1.25 (0.74, 2.11)
CNS medications	291 (32.4%)	29 (10.0%)	55 (9.1%)	1.14 (0.73, 1.79)	1.68 (0.97, 2.92)
No intellectual disability	647 (67.8%)	68 (10.5%)	16 (5.2%)	1.93 (1.12, 3.33)*	1.59 (0.87, 2.90)
<i>Physical health</i>					
≥1 chronic smoking-related disease(s)	548 (56.4%)	48 (8.8%)	38 (9.0%)	0.92 (0.60, 1.41)	0.77 (0.48, 1.24)
Lifetime asthma diagnosis	349 (35.9%)	35 (10.1%)	51 (8.2%)	1.28 (0.83, 1.97)	1.13 (0.70, 1.81)
Obese according to BMI	168 (17.4%)	16 (9.5%)	68 (8.5%)	1.04 (0.60, 1.79)	0.97 (0.54, 1.76)
Good physical health (SF36)	827 (86.5%)	70 (8.5%)	16 (12.4%)	0.70 (0.41, 1.21)	1.18 (0.61, 2.26)
High Patient Activation (PAM)	745 (77.5%)	71 (9.5%)	14 (6.5%)	1.49 (0.84, 2.64)	1.43 (0.75, 2.70)
Non-CNS medications	136 (14.0%)	21 (15.4%)	65 (7.8%)	1.97 (1.20, 3.22)**	2.29 (1.24, 4.22)**
<i>Social/reintegration support</i>					
Low perceived social support (ESSI)	228 (23.6%)	22 (9.7%)	64 (8.7%)	1.10 (0.68, 1.78)	1.25 (0.72, 2.17)
No post-release support	827 (85.3%)	73 (8.8%)	13 (9.1%)	1.05 (0.58, 1.90)	0.96 (0.51, 1.80)
Passports intervention	497 (51.1%)	46 (9.3%)	40 (8.4%)	1.11 (0.73, 1.70)	N/A

^a In the month prior to incarceration; ^b In 6 months prior to incarceration; ^c Based on income in 4 weeks prior to incarceration; * $p < 0.05$; ** $p < 0.01$; FTND: Fagerström Test for Nicotine Dependence; AUDIT: The Alcohol Use Disorder Identification Test; ASSIST: Alcohol, Smoking and Substance Involvement Screening Test; K10: Kessler Psychological Distress Scale; CNS: Central Nervous System; BMI: body mass index; SF36 PCS: Short Form 36 Health Survey version 2 (physical component); PAM: Patient Activation Measure; ESSI: Enriched Social Support Inventory.

Figure 1: Kaplan-Meier curves showing time to first SCP after release from prison, according to age category

DISCUSSION

In a large cohort of adult smokers followed prospectively from prison into the community, we found that fewer than one in ten was supplied with subsidised SCP over a period of two years, despite many likely having a desire to quit [2,5] and SCP being available at very low cost. Although there are no comparable national data, one population-wide study of Australian smokers [39] found that 52.2% had ever used any form of SCP. There is a clear and pressing need to identify and eliminate barriers to SCP uptake, to reduce rates of smoking and related morbidity in this highly vulnerable population.

Consistent with population studies, we found that SCP uptake was greater for those employed before prison [40,41] and for those aged 25 years or older, [36,39,42–44] an

unfortunate finding considering that younger smokers benefit most from cessation. [45,46] Furthermore, individuals taking medication for physical health conditions (non-CNS medications) in prison were more likely to be supplied with SCP, perhaps mediated by greater contact with health professionals for ongoing management of other medication needs. [47] To the extent that this is the case, it is notable that we found no association between use of psychotropic medications and SCP uptake. This may reflect diagnostic overshadowing, [48] with physicians focussing on management of mental illness to the detriment of other health problems. [49]

Participants who used cannabis and methamphetamine at risky levels before prison were less likely to be supplied with SCP after release from prison, although these associations were attenuated to the null in multivariate analyses. Other studies have shown that patterns of substance use before prison are strongly predictive of substance use after release from prison. [50–53] Efforts to promote tobacco cessation in ex-prisoners and other populations with a high prevalence of co-occurring illicit substance use should provide coordinated, evidence-based treatment for both substances. [54,55]

Our findings highlight a clear need to improve uptake of SCP in ex-prisoners, but it remains unclear how best to achieve this. Based on a previous review of the literature and informed by our own findings, we recommend a cohesive policy and practice shift that focuses on: 1) improving ex-prisoners' knowledge of SCP's effectiveness and accessibility; and 2) increasing contact with primary care after release from prison. Primary care physicians have a crucial role to play in improving the health of ex-prisoners [56,57] and can improve abstinence rates and motivate quit attempts, [58,59] especially in patients with complex health and welfare needs. [36] Providing access to PBS-subsided medication *in* prison may also improve SCP uptake in this population. [60] As prisoners typically experience improved health while incarcerated, [2,61,62] the provision of SCP in prison, even for time periods as

short as three weeks,[23] could assist prisoners in maintaining their improved health post-release [34,60] through the reduction of physiological and psychomotor withdrawal symptoms experienced during quit attempts. [63]

Limitations

This is the first ever study to examine SCP uptake in smokers after release from prison. It has three main limitations. First, because nicotine patches were only listed on the PBS on the 1st of February 2011, while follow-up in this study was from 10 September 2008 until 12 August 2012, we may have under-ascertained uptake of nicotine patches due to individuals purchasing patches without a PBS subsidy. Second, participants may have purchased any form of non-subsidised NRT during follow-up, leading to possible underestimation of NRT access. However, rates of primary care contact in this population are roughly twice as high as in the age- and sex-matched general population, and a large proportion of contacts results in a prescription being filled. [64] Third, we relied on self-report for measurement of most baseline variables. However, there is growing evidence that self-reported health information in incarcerated populations can be reliable.[65]

CONCLUSION

The majority of people who cycle through prisons smoke, and many wish to quit. Even in the context of government subsidised SCP, only a small proportion of ex-prisoners accessed subsidised SCP in the two years following release from prison. Our findings highlight a missed opportunity to improve health outcomes for this marginalised and under-served population. Further research is required to identify barriers to SCP uptake following release from prison.

What this paper adds

What is known on this topic?

- The vast majority of prisoners smoke tobacco, and people who cycle through prisons are at increased risk of smoking-related morbidity and mortality. Smoking cessation pharmacotherapy (SCP), recognised for its effectiveness in assisting with smoking cessation, is available at a heavily subsidised rate in the Australian community.
- No studies have examined use of SCP after release from prison.

What this study adds?

- Only a small proportion of smokers released from prison accessed SCP, pointing to a missed opportunity to reduce smoking in this vulnerable population.
- Those who were aged 25 years or older, were employed before prison, used non-CNS medications in prison, and were heavily nicotine dependent, were more likely to access subsidised SCP following release from prison.

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Competing Interests

The authors declare that they have no competing interests

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