

# OUD Care Service Improvement with Prolonged-release Buprenorphine in Prisons: Cost Estimation Analysis

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**Background:** In prisons in England, integrated treatment for opioid use disorder (OUD) is accessible and effective, commonly based on daily supervised consumption of methadone. Treatment limitations (inadequate dosing, nonengagement with care, stigma, diversion and bullying) are noted. Flexible dose, injectable prolonged-release buprenorphine (PRB) which removes the need for daily dispensing and supervision is suggested for prisoner care. This work aimed to predict the difference in costs of current standard of care vs partial introduction of PRB.

**Methods:** A predictive model of compared costs for the provision of OUD care in the prison setting in England evaluated current standard of care (all receive methadone) with a future situation of 30% of prisoners electing to use a monthly dose of PRB. Evidence describing costs to deliver OUD care for 150 prisoners (pharmacotherapy, direct service, indirect health care, indirect security costs) were collected, including assumptions describing how care would be delivered. Evidence sources include national data sources, scientific literature and from experience in the prison health care setting.

**Results:** For a representative standard prison population requiring OUD care of 150 prisoners in England PRB introduction is associated with a predicted reduction in direct and indirect costs of OUD care. Annual OUD care costs for current standard of care were £0.6M; with 30% PRB costs reduced by £8665, more than 3000 hours of staff time is saved. Sensitivity analyses showed greater adoption of PRB resulted in further cost reduction.

**Conclusion:** PRB can address limitations of OUD care in prisons and improve outcomes. Introduction does not increase cost of care in this predictive analysis. PRB may lead the transformation of prisoner OUD care.

**Keywords:** opioid use disorder, pharmacotherapy, prolonged-release buprenorphine, prisoners

## Introduction

There is an opportunity to improve opioid use disorder (OUD) care in prisons. OUD is associated with serious adverse health and social outcomes.<sup>1</sup> People with OUD often face social disadvantage, may find it difficult to access appropriate health care services<sup>2</sup> and are disproportionately represented in the criminal justice system,<sup>3-5</sup> related to acquisitive crime and illegal substances possession.<sup>6</sup> It is estimated that 60% have a history of problem drug use, 35% may be engaged in OUD treatment programs in prisons.<sup>7</sup> For many, prison-based health-care is an important opportunity to engage with services not accessed in the community.<sup>8</sup>

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Pharmacotherapy, commonly methadone administered each day under supervision of custodial prison and health-care staff,<sup>9</sup> is the standard of care for prisoners in England<sup>3,5,10</sup> and is effective and well-evidenced.<sup>11–13</sup> OUD care in prison is associated with limitations: attendance for observed therapy may increase the chance of bullying, harassment and exploitation<sup>3</sup> and limit time for employment and rehabilitation. Diversion and misuse of medications is a recognized problem in the prison setting.<sup>3,14</sup> The risk of diversion limits access to oral buprenorphine as a choice in therapy.<sup>3</sup> Suboptimal dosing may occur in the prison setting<sup>15</sup> and increases likelihood of engagement in “on top” use of opioids or other drugs obtained through illicit routes. On release many do not continue to engage with treatment services;<sup>16</sup> there is an important risk of overdose following exposure to illicit heroin on release.<sup>17</sup>

Flexible dose, injectable prolonged-release buprenorphine (PRB), administered by injection with various doses providing a sustained therapeutic plasma concentration of buprenorphine over weekly or monthly dosing intervals, has been available in the UK since January 2019<sup>18</sup> with demonstrated efficacy.<sup>19–21</sup> PRB minimizes risk of diversion, removes the need for daily dispensing, limits stigma and bullying risk associated with oral observed therapy and may be a useful choice when clarity for counselling to address trauma is required.<sup>22</sup> PRB has been recommended<sup>23,24</sup> with potential benefits defined<sup>25</sup> and studied, in the prison setting.<sup>26</sup> The objective of this work was to compare estimated costs of providing the standard of care with PRB introduction.

## Method

A predictive model to estimate the costs of OUD care in prison was prepared from the perspective of the health-care provider. The setting was the public prison system in England, in which health care is the responsibility of the National Health Service. Costs to deliver OUD care (pharmacotherapy, direct service, indirect health care or security) were calculated for a typical representative standard prisoner population. Costs were compared for the current standard of care (all treated prisoners receive methadone medication) and with a novel approach assuming 30% elect for PRB therapy.

Direct costs for OUD care consisted of drug and staff costs. Drug costs: cost of methadone was calculated based on an average daily dose of 60 mg per patient, the minimum therapeutic dose recognized in national guidelines<sup>5</sup> and listed unit cost data. PRB drug cost was determined from the fixed cost for 30-day supply in England.<sup>19</sup>

To estimate staff costs related to the provision of observed methadone consumption in a prison, a process map of activities required for treatment delivery was created based on evidence from three prisons. Time to complete activities was determined (Table 1) and unit costs for staff time applied. Activities included: (1) Setup: preparation tasks before initiating the dispensing process. (2) Escort to treatment: transfer of prisoners between cells and dispensing location. (3) Dispensing: daily dispensing of medications at the designated location and supervision of this process. (4) Completion: “close down”, tasks including cleaning the automated dispensing system and recording of final stock balance. (5) Administration: tasks to manage the procurement and daily supply within the prison of a controlled drug including medication orders, medication transport, script checks, spillage investigations.

For monthly PRB treatment a novel treatment process was assumed with pharmacotherapy administered during

**Table 1** Direct Costs: Utilization Rates

Cost Type		Utilization	
Medication		Methadone	Prolonged-release buprenorphine
		Daily dose 60 mg	Monthly dose 8, 16, 24, 32 mg
Dispensing system		1*	0**
Staff	Process	Resource use <sup>#</sup> (h/week)	
Prison officer	Escort offenders Dispensing	63.0 31.5	0.0 0.0
Nurse	Setup Dispensing Completion	5.3 31.5 5.3	0.0 6.0 0.0
Pharmacy technician	Setup Dispensing Completion Weekly administration	5.3 31.5 5.3 16.5	0.0 3.0 0.0 3.0
Pharmacist	Weekly administration	25.5	9.8
Prescriber	Weekly administration	7.5	3.8

**Notes:** \*One Methasoft system set up for a prison with 150 people in treatment. \*\*Does not require automatic dispensing system. <sup>#</sup>Describes weekly staff resource required to serve 150 patients in treatment.

**Table 2** Indirect Costs: Utilization Rates

Cost Type	Utilization (Events/Year) <sup>a</sup>		
	Methadone	Prolonged-release Buprenorphine	Reference
Indirect health care			
Diversion-related medication review	780.00	0.00	<sup>30</sup> Assumption
Overdose	156.00	78.00	<sup>30,31b</sup>
Ambulance call out for overdose	0.86	0.47	<sup>31,32b</sup>
Drug-related death (in custody)	0.04	0.02	<sup>31,33b</sup>
Drug-related death (post release)	0.75	0.45	<sup>31,34b</sup>
Indirect security/criminal justice			
Adjudications for violence	52.5	36.00	<sup>30,35b</sup>
Sentence day added for violence	4.65	3.30	<sup>30,35b</sup>
Adjudication for diversion attempt	780.00	0.00	<sup>30</sup> Assumption
Arrest (post release)	61.5	21.00	<sup>36,37b</sup>
Court appearance (post release)	61.5	21.00	<sup>36,37b</sup>

**Notes:** <sup>a</sup>Number of occurrences annually per 150 patients in treatment. <sup>b</sup>Model input values assumed based on extrapolation of referenced data.

a 10-minute nurse appointment during a preexisting health care appointment<sup>27</sup> without daily supervision.

Events determining indirect health-care costs and indirect security or criminal justice costs relating to OUD in prisons were identified (Table 2) from typical practice in three prisons or other published evidence, with assumptions for related costs (Table 3). These included: medication reviews following attempted diversion, staff costs associated with an overdose incident, naloxone medication provision, emergency medical service or ambulance call outs, drug-related deaths during custody and in a one-year period following release.

Indirect security or criminal justice costs included: management time for investigation of, and arrests for violence related to, the diversion of OUD medication. This included adjudications or sentencing, punishment (including added sentence days).

A standard OUD treatment population of 150 prisoners was assessed for the purposes of the estimation. This was based on an average prison population of 700, calculated from national statistics,<sup>28</sup> and reported rates of uptake of OUD treatment.<sup>7</sup>

Current standard of care included 100% methadone use, as is common in England. The comparison modelled a 30% adoption of monthly dose of PRB, in line with buprenorphine prescribing in community practice.<sup>29</sup>

A sensitivity analysis was performed to assess the impact of key parameters which may be variable across prisons including medication dose, staff time, and new therapy adoption level on overall costs.

## Results

Introduction of PRB for 30% of care is associated with a modelled cost reduction of £8665 (Table 4). Standard of care costs were £292,420 (direct service), £96,632

**Table 3** Unitary Costs

Cost Parameter	Unit Cost (£)	Reference
Medication		
Methadone (1 mg/mL, oral solution)	0.54/60 mg dose	<sup>38</sup>
Prolonged-release buprenorphine	239.70/30-day supply	<sup>19</sup>
Logistics		
Dispensing system fee	200.00/month	<sup>39</sup>
Staff, hourly rate		
Prison officer	19.15	<sup>40</sup>
Nurse	22.70	<sup>41</sup>
Pharmacy technician	17.02	<sup>42</sup>
Pharmacist	28.37	<sup>43</sup>
Prescriber	67.38	<sup>44</sup>
Indirect healthcare		
Medication review	17.00	<sup>30,44</sup>
Overdose (staff resource)	195.00	<sup>30,40,41</sup>
Naloxone (400 µg/mL)	8.16	<sup>38</sup>
Ambulance callout	300.00	<sup>45</sup>
Drug-related death (in custody)	60,000.00	<sup>30</sup>
Drug-related death (post release)	60,000.00	<sup>30</sup>
Indirect security/criminal justice		
Adjudication	30.00	<sup>30,40</sup>
Added sentence day	103.00	<sup>46</sup>
Arrest	2199.68	<sup>47</sup>
Court appearance	1100.78	<sup>47</sup>

**Table 4** Budgetary Impact Results

	Standard of Care	PRB Introduction	Difference
Patients in treatment (n)			
Methadone	150	105	-45
Prolonged-release buprenorphine	0	45	+45
Annual costs (£)			
Direct service cost			
Medication cost	29,484	151,515	122,031
Dispensing system fee	3600	2520	-1080
Staff cost			
Prison Officer	94,098	65,869	-28,229
Nurse	49,566	36,820	-12,746
Pharmacy technician	51,779	37,838	-13,940
Pharmacist	37,617	30,647	-6,970
Prescriber	26,277	22,335	-3941
<b>Total direct service</b>	<b>£292,420</b>	<b>£347,544</b>	<b>£55,124</b>
Indirect health-care costs			
Diversion-related medication review	13,260	9282	-3978
Overdose (staff resource)	30,420	25,857	-4563
Naloxone	1273	1082	-191
Ambulance callout	255	217	-38
Drug-related death (in custody)	2494	2120	-374
Drug-related death (postrelease)	48,930	41,591	-7340
<b>Total indirect health care</b>	<b>£96,632</b>	<b>£80,148</b>	<b>-£16,484</b>
Indirect security/criminal justice costs			
Adjudication: drug-related violence	1572	1431	-142
Adjudication: diversion	23,400	16,380	-7020
Sentence extension: drug-related violence	475	432	-43
Arrests	135,280	108,554	-26,726
Court Appearances	67,698	54,323	-13,374
<b>Total indirect security/criminal justice</b>	<b>£228,425</b>	<b>£181,120</b>	<b>-£47,305</b>
<b>Total</b>	<b>£617,477</b>	<b>£608,813</b>	<b>-£8665</b>

(indirect health care) and £228,425 (indirect security or criminal justice). With PRB introduction predicted costs were £347,544, £80,148 and £181,120 respectively. Staff time of 3159 hours per year is available for other activities with the introduction of PRB, compared to standard of care ([Appendix 1](#)).

Sensitivity analysis assessed impact of medication dose, staff time needed to deliver treatment with methadone and prolonged-release buprenorphine, and adoption level of PRB on overall costs ([Appendix 2](#)). The analysis showed higher savings in prisons prescribing higher doses of methadone, or where staff time to deliver standard of care is greater, possibly due to prison geography or other security factors. A higher rate (50%) of PRB adoption is associated with predicted cost reduction of £14,441

compared to standard of care. Additional analysis showed a cost saving of £2624 for a scenario in which half of the PRB cohort receive weekly medication instead of monthly.

## Discussion

The introduction of PRB as an option for pharmacotherapy was associated with a predicted reduction in total costs for OUD care for a typical population requiring OUD treatment in a prison in England. The evaluation predicted a reduction in indirect health care costs and security or criminal justice costs by 17% and 21% respectively, offsetting increases in direct costs. Reductions in staff time of 27% were predicted.

PRB can address limitations to the current prison OUD care system: optimal dosing for a sufficient duration, daily attendance at prison health care for observed therapy, the

risk of bullying and harassment of prisoners to divert medications, maintaining continuity of buprenorphine care<sup>3,15</sup> avoiding the need to change to methadone.<sup>3</sup> PRB may also benefit prisoners on release providing continuing treatment depending on recent administration and potentially changing the well described risk of overdose on release. Access to PRB may be very important at times when moving prisoners or personnel around the prison is highly undesirable and presents a significant health risk. PRB is likely a key resource when infectious disease or COVID-19 outbreaks are present.

There are limitations to this work. This is a predictive analysis based on assumptions—studies following introduction of PRB should test these results.

For the purpose of this analysis a “typical” prison setting, in which provision of pharmacotherapy forms a major part of the daily routine, was used for calculation of costs. In practice, costs to deliver care in an individual prison vary depending on caseload, prison geography, and security category. In prisons in which treatment services prescribe greater amounts of sublingual buprenorphine, baseline costs are likely to be significantly higher, and cost reduction from the introduction of PRB greater. This analysis is based on introduction of the PRB product which, according to the approved summary of product characteristics, does not require initiation with transmucosal buprenorphine-containing product followed by minimum seven days dose adjustment. Resources (time and cost of product) are not allocated for an induction phase. It is assumed for this analysis, those electing for PRB have previous experience of buprenorphine therapy.

Benefits over a longer period at a population level should also be assessed. In this analysis, the assumed reduction in mortality rate on release is based on a conservative approach: there may be a larger reduction in deaths for those maintaining PRB therapy on release. There are also likely other benefits not accounted for in this analysis. These other benefits may include: reallocation of staff time to provide improved OUD care, effective pharmacotherapy and continuity of care may be associated with improved treatment retention or less frequent “on top” use of illicit drugs, reduced bullying, violence or offences related to illicit drug use and lower mortality from opioid overdose which is a risk for prisoners, especially on release.

## Conclusion

PRB offers an opportunity to improve care for OUD in prisons and can directly address many of the limitations of

treatment today while reducing overall resource needs. It is recommended that decision-makers consider the benefits to individuals and the prison environment in general which may be offered by PRB in the context of overall cost reduction.

## Abbreviations

OUD, opioid use disorder; PRB, prolonged-release buprenorphine.

## Data Sharing Statement

All data generated or analysed during this study are included in this published article.

## Ethics Approval and Consent to Participate

This is a nonhuman study based on analytical estimation of the cost of care. Ethics approval is not required.

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## Disclosure

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