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Understanding diversion of prescribed opioid agonist medications in Birmingham, UK—prevalence and predictors of diversion

Kevin Ratcliffe, Binna Chopra, and Ed Day

Birmingham & Solihull Mental Health Foundation Trust, Birmingham, UK

Summary

Background: Opioid agonist treatment (OAT) is an evidence-based intervention but concerns persist regarding diversion. Aim: This study assessed the prevalence of and motivating factors behind OAT diversion and acquisition of illicit OAT self-reported by persons treated within OAT programmes or accessing needle and syringe programmes (NSPs) in Birmingham, UK. Methods: 511 people in OAT programmes and 105 NSP users completed anonymous questionnaires consisting of 25 open and closed questions. Logistic regression analysis was used to explore associations between OAT diversion and acquisition of illicit OAT. Results: 32.5% (95% CI 28.4-36.6%) of people in OAT programmes self-reported diversion at some point. 12.1% (n=62) had diverted at least once a week. 25.2% (n=129) reported current diversion, with giving it away (n=64, 49.6%) more common than selling (n=21, 16.3%); 44 (34.1%) reported both reasons. In NSPs, most was purchased (67/74, 90.5%). In OAT programmes, the likelihood of diversion was higher in those who continued to use illicit drugs (OR=3.65, 95% CI 1.76–7.56, p=0.0005) and in people not taking the full dose of OAT. Rates of diversion appeared to be similar among all subgroups of illicit drug users. No difference in the risk of diversion of methadone and buprenorphine was found. OAT acquisition was common in OAT programmes (63.6%, 95% CI 59.4–67.8) and highly associated with continued illicit drug use and long-duration in treatment, and common in NSPs (70.5%, 95% CI 61.8–79.2%). Conclusions: Diversion and acquisition rates of OAT were high but consistent with previous European studies. The predictors identified offer important clues to reduce these activities, and point to the importance of optimised OAT with awareness of diversion potential, side effect profile, and effective supervision.

Key Words: Opioid agonist treatment; Methadone; Buprenorphine; Diversion; Acquisition; Illicit drugs

1. Introduction

Opioid agonist treatment (OAT) is an evidence-based intervention that has a number of potential benefits for people with opioid dependence and for wider society in general [7, 18, 19]. Broadly, OAT reduces illicit opioid use, retains patients in treatment, and is associated with reductions in criminal activity, overdose risk, and transmission of blood-borne viruses [4, 5, 7, 16, 18, 19, 21]. However, concerns persist regarding diversion of prescribed OAT onto the 'black market', particularly around the increased potential for drug-related deaths [1, 8], but also because of diminishing treatment benefits where this occurs. The argument that diversion leads to increased risk of harm is a powerful one. The most recent data from the Office of National Statistics reported 429 drug-related deaths with methadone mentioned on the death certificate in England and Wales in 2013 [20]. The National Drug-related Deaths Database (Scotland) Report 2013 reported that methadone was implicated in 42% of deaths and the majority of individuals who died from a drug-related death (69.2%) were not in receipt of an OAT prescription at the time of death [12].

There is a perception that diversion of OAT is common [2, 8], and a recent systematic review reported a diversion rate globally of 23 to 39% of cases [1]. Studies have suggested diversion rates are higher with buprenorphine than methadone [13, 23, 24]. Some clinicians have argued that diversion may have a protective factor—for example, if a patient misses a col-

Corresponding author: Kevin Ratcliffe FRPharmS (IP) FFRPS, Consultant Pharmacist, Reach Out Recovery, Scala House, 36 Holloway Circus, Birmingham B1 1EQ, UK
Email: kevin.frpharms@gmail.com

lection of their prescribed methadone and buys some methadone on the 'black market' rather than resorting to using heroin again [1, 17]. However, research into the extent of diversion of OAT and the motivating factors behind it is quite limited in the UK. This is particularly true for buprenorphine-based OAT; there are remarkably few data describing the diversion of buprenorphine in the UK.

The primary aim of this study was to assess the prevalence of, and predictive factors of, diversion and acquisition of prescribed OAT reported by persons treated within OAT programmes in Birmingham, UK. Secondary aims were to assess the prevalence of OAT acquisition reported by individuals who were accessing needle and syringe programmes (NSPs), and to report perceptions of the availability of diverted OAT on the black market.

2. Methods

2.1. Participants

Participants were recruited between July and December 2014. Participants treated within OAT programmes were recruited from four specialist treatment sites across Birmingham managed by Birmingham and Solihull Mental Health NHS Foundation Trust. Any service user aged 18 years or over who was currently prescribed OAT was eligible to take part. The set number for sequential enrolment was 125 at each centre. Participants accessing NSPs were recruited from centres in Birmingham. The inclusion criterion was at least age 18 years of age and accessing an NSP. The planned sequential enrolment was 100 people. National Health Service Research Ethics Committee and the R&D Committee for the host organisation (Birmingham & Solihull Mental Health Foundation Trust) approved the design and procedure for this study (including the questionnaire).

2.2. Instruments

2.2.1. Questionnaire

The questionnaire used consisted of a mixture of 25 open and closed questions that was developed by the research team based on previous studies, and was peer reviewed by the service user group.

Each participant was asked to complete the questionnaire anonymously. For participants treated within OAT programmes, a researcher was stationed in each clinical team waiting room and approached sequential clients attending routine appointments until the set number of clients were enrolled. Those recruited from NSPs were approached at various centres within the City.

Before commencing the questionnaire, participants were asked to confirm that they had not completed this questionnaire previously. The researcher explained verbally that continuing with the questionnaire was accepted as consent to participate in the research. If the service user wished to proceed with the questionnaire, the researcher read a short briefing explaining the process and the confidential nature of the questionnaire and confirming that participation would not affect treatment. The team was keen to promote confidentiality in order to maximise full disclosure, and as such only basic demographic information was collected on the questionnaire. The researcher told the participants that they could choose to stop completing the questionnaire should they become uncomfortable answering the questions; this questionnaire would then be shredded and would not be included in the study. The questionnaires were completed in areas that enabled confidentiality yet allowing access to the researcher if clarification was needed.

The questionnaire specified the OAT medications as methadone, buprenorphine/Subutex (referring to generic mono-buprenorphine or branded Subutex® and described as buprenorphine in this manuscript), and Suboxone® (referring to branded buprenorphine/naloxone and described as Suboxone in this manuscript). Participants who completed the survey received a shopping voucher (Love2Shop) worth £5 as compensation for their time.

2.2.2. Definition of diversion

Study participants were asked five questions about their prescribed opioid agonist medication and diversion. Participants were asked, 'Do you take the full amount of your prescribed medication every day', with possible answers being yes, usually, sometimes, and no. The next question was 'If you don't take the full amount [of your prescribed substitution medication every day], what do you do with the remainder… (a) keep for emergencies, (b) sell it, (c) give it away, (d) return it to the pharmacy, (e) dispose of it at home, (f) other? Current diversion of OAT was defined as a positive answer to (b) or (c) and this was used as the dependent variable in logistic regression. Participants were also asked: 'If you have ever sold or given your substitution medication to someone else, how often have you done this…(a) daily, (b) 3-4 times a week, (c) once a week, (d) once or twice a month, (e) never. Positive answers to a–d were regarded as positive for

diverting OAT at some point, i.e. ever diverting OAT.

2.2.3. Definition of acquisition of extra OAT medication

The question asked was, 'Have you ever bought/got hold of extra substitution medication, and if so, why did you do so?' The options were (a) never done this, (b) pharmacy was closed/missed collection, (c) prescribed dose not holding me, (d) off my script, (e) travelling and (f) other. 'Off my script' was defined as periods of time between treatment episodes whereby the service user was not in receipt of a prescription for OAT, for example when waiting for a treatment restart. Study participants who gave at least one reason for acquiring extra OAT (b–f) were regarded as positive for ever having acquired extra OAT.

2.2.4. Definition of perceived availability of illicit OAT

To investigate the differences in perception of the availability of illicit OAT, the answers to the question 'How easily available do you think these drugs [methadone mixture, methadone tablets, buprenorphine, Suboxone] are available to buy locally in the streets/black market' were analysed. In this question, a distinction was made between methadone tablets and methadone mixture. There were five possible responses: very easy, easy, a little difficult, really difficult and do not know. For the purposes of the analysis, we considered the 'Don't know' category as neither easy nor difficult and placed it in the middle of the scale of ease.

2.2.5. Definition of illicit drug use

Participants were asked about the frequency of current illicit drug use, 'How often do you take illicit drugs in addition to or instead if your substitution treatment'. The possible answers were (a) daily, (b) 3-4 times a week, (c) once a week, (d) once or twice a month and (e) never. In the next question, participants were asked why, with possible answers (a) I need to if I miss appointments/pickup, (b) I need to when I am travelling, (c) drug treatment does not control cravings very well, (d) wanted to get a buzz/high occasionally and (e) other reason.

2.3. Data analysis

Continuous data are presented as mean +/- standard deviation. Categorical data are expressed as number and percentage. Comparisons of differences in categorical data between groups were performed using Chi-squared test. Logistic regression analyses were performed to assess variables that may influence diversion and acquisition of OAT, and a proportional odds logistic regression was performed to compare the ordinal variable of perceived availability of illicit OAT.

For diversion and acquisition of OAT, simple logistic regression was performed with each variable fitted individually and then a full multivariable model was fitted, which included all variables. A reduced model was formed by discarding candidate predictors that did not contribute to explaining the variability of the dependent variable, defined as $p>0.05$, and accounting for interactions. The selection of predictor variables for investigation was based on previous risk factors reported for diversion of OAT in England [16] and on the research team's own experience of factors potentially related to diversion, such as type of OAT medication and past imprisonment. The predictor variables chosen included demographic, social and treatment factors. These were: age, gender, prison history, current illicit drug use (any illicit drug), OAT type (methadone, buprenorphine), OAT duration (<1 year, 1-2 years, 3-5 years and >5 years), OAT dose, OAT collection frequency (daily, 2–5 times/week, once per week), and supervision requirement. For OAT dose, the values were grouped into five dose ranges. For methadone, these were: up to 40 mg (dose group 1), 40–59 mg (group 2), 60–79 mg (group 3), 80–99 mg (group 4), and ≥100 mg (group 5). For buprenorphine, the dose groups were: up to 4 mg (dose group 1), 4–7 mg (group 2), 8–11 mg (group 3), 12–15 mg (group 4), and ≥16 mg (group 5). The reasons given by the participants for not taking the full amount of OAT were included as predictor variables for the diversion model, but were not relevant for the modelling of acquisition of extra OAT.

Participants prescribed Suboxone (n=6) were excluded from all logistic regression models because it was deemed inappropriate to combine these few cases with buprenorphine, but perceptions about Suboxone availability were included in the analysis of availability of OAT medications generally. Analyses were performed using SAS statistical software, v.9.3 (SAS Institute Inc., Cary, NC).

3. Results

3.1. Participant characteristics

511 participants were recruited from OAT programmes. There were no refusals to participate in the survey. 75% were male and the mean age was 37.1 years (s.d. 8.3, range 22–66) (Table 1). OAT

Table 1 Frequency of variables in 511 participants recruited from OAT programmes according to current diversion

Term	Diversion-negative (n=382)	Diversion-positive (n=129)	All (n=511)
Age, years (sd)*	37.0	37.5	37.1 (8.3)
Sex (male)	74.9% (286)	78.3% (101)	75.7% (387)
Prison within last 6 months	21.7% (83)	25.6% (33)	22.7% (116)
Illicit drug use	74.6% (285)	93% (120)	79.3% (405)
Medication type (methadone)	78% (298)	79.8% (103)	78.7% (406)
Frequency of OAT collection			
≥6 days a week	73.6% (281)	77.5% (100)	74.6% (381)
5 days a week	3.9% (15)	2.3% (3)	3.5% (18)
3 days a week	3.9% (15)	3.1% (4)	3.7% (19)
2 days a week	5.% (22)	2.3% (3)	4.9% (25)
1 days a week	12.8% (49)	14.7% (19)	13.3% (68)
OAT supervision	68.3% (261)	63.6% (82)	343 (67.1%)
OAT duration			
Less than 1 year	17% (65)	11.6% (15)	80 (15.7%)
1-2 years	17.5% (67)	13.2% (17)	84 (16.4%)
3-5 years	18.6% (71)	19.4% (25)	96 (18.8%)
More than 5 years	46.6% (179)	55.8% (72)	251 (49.1%)
OAT not full amount			
Don't need it	5.8% (22)	12.4% (16)	38 (7.4%)
Getting side effects	2.6% (10)	7.8% (10)	20 (3.9%)
Gradually reducing dose	7.9% (30)	17.1% (22)	52 (10.2%)
Reduced/no dose on days that I use	1.1% (4)	3.1% (4)	8 (1.6%)
Other reason	6.8% (26)	14% (18)	44 (8.6%)

OAT, opioid agonist treatment; sd, standard deviation; * Mean values

was predominantly methadone (78.0%, n=401), with 104 (20.4%) prescribed buprenorphine, and 6 (1.2%) were prescribed Suboxone. Among those participants who were currently prescribed methadone, 55% were receiving doses of 60 mg a day or more (mean dose 52.6 mg). For buprenorphine and Suboxone, 35% were receiving a dose of at least 12 mg (mean dose 10.5 mg). The dosing was supervised in 67% of participants. Frequent collection was the norm with 75% of participants on daily collection from the pharmacy. OAT duration was less than one year in 16% (n=80) and more than 5 years in 39% (n=251). Current illicit drug use in addition to or instead of OAT was common (79.4%). In total, 22.7% (n=116) had been in prison in the last 6 months.

105 participants were recruited from NSPs. They were predominantly male (83.6%), with a mean age was 35.5 years (s.d. 7.7, range 21–56). No NSP participants were currently receiving prescribed OAT; 71.4% (n=75) had received OAT in the past, in most cases (n=49) more than 6 months ago. 30.5% (n=32) had been in prison in the last 6 months.

3.2. Diversion of OAT by persons recruited from OAT programmes

3.2.1 Prevalence of OAT diversion

32.5% (95% confidence interval (CI), 28.4 to 36.6%) had diverted their medication at some point, and of these, 37.4% (n=62) had diverted at least once a week. Helping others to treat withdrawal was the most common reason given (89%) and earning money was less common (39%). Comparing methadone and buprenorphine, 32.9% (132/401) and 32.7% (34/104), respectively, diverted their current medication.

25.2% (95% confidence interval (CI), 21.4 to 29.0%) reported current diversion. Of those, giving it away (n=64, 49.6%) was more common than selling (n=21, 16.3%), while 44 people (34.1%) reported both reasons. Comparing methadone and buprenorphine, 25.7% (103/401) and 25.0% (26/104) respectively diverted their current medication.

3.2.2. Predictors of OAT diversion

Simple logistic regression of individual variables identified continued illicit drug use and all the reasons given for not taking the full amount of OAT medication (except for 'reduced or no dose on days

Table 2 Predictors of current diversion of substitution medication by persons recruited from OAT programmes (n=505)

	Simple logistic regression			Multivariable logistic regression reduced model		
	OR	95% CI	P	OR	95% CI	P
Age (per year)	1.01	0.98–1.03	0.571	-	-	-
Gender						
Female	1 (reference)					
Male	1.20	0.75–1.94	0.451	-	-	-
Prison within last 6 months						
No	1 (reference)					
Yes	1.25	0.79–1.99	0.344	-	-	-
Illicit drug use						
No	1 (reference)					
Yes	4.57	2.23–9.35	<0.0001	3.65	1.76–7.56	0.0005
OAT medication type						
Buprenorphine	1 (reference)					
Methadone	1.04	0.63–1.70	0.887	-	-	-
OAT dose group			0.945*			
Dose group 5	1 (reference)					
Dose group 1	1.11	0.49–2.51		-	-	-
Dose group 2	0.98	0.45–2.12		-	-	-
Dose group 3	0.91	0.41–1.98		-	-	-
Dose group 4	0.83	0.32–2.12		-	-	-
Frequency of OAT collection			0.245*			
Once per week	1 (reference)					
Daily	1.34	0.52–1.66		-	-	-
2–5 times/week	0.52	0.22–1.22		-	-	-
OAT supervision						
No	1 (reference)					
Yes	0.81	0.53–1.23	0.319	-	-	-
Duration of OAT			0.245*			
>5 years	1 (reference)					
<1 year	0.59	0.32–1.10		-	-	-
1-2 years	0.64	0.35–1.16		-	-	-
3-5 years	0.90	0.53–1.53		-	-	-
Not taking OAT full amount						
‘Don’t feel I need it’—no	1 (reference)					
‘Don’t feel I need it’—yes	2.28	1.16–4.49	0.017	2.18	1.06–4.46	0.034
‘Getting side effects’—no	1 (reference)					
‘Getting side effects’—yes	3.08	1.25–7.57	0.015	2.97	1.15–7.69	0.025
‘Gradually reducing my dose’—no	1 (reference)					
‘Gradually reducing my dose’—yes	2.37	1.31–4.28	0.004	2.43	1.31–4.50	0.005
‘Reduced dose/no dose’—no	1 (reference)					
‘Reduced dose/no dose’—yes	2.98	0.73–12.08	0.130	-	-	-
‘Other reason’—no	1 (reference)					
‘Other reason’—yes	2.18	1.15–4.13	0.016	2.41	1.24–4.67	0.009

* For terms with more than two levels (e.g. dose group), the significance of the predictor overall is presented.
OR = odds ratio; CI, confidence interval; OAT, opioid agonist treatment

that I use’) as significant predictors of diversion (Table 2). These factors remained significant when analysed with all the covariates in multivariable logistic regression. A reduced model comprising illicit drug use and the four significant variables for not taking the full amount of OAT medication was fitted and is

Table 3 Reasons for illicit drug use given by persons recruited from OAT programmes (n=402)

Reason	Methadone*	Buprenorphine*
N	318	78
Wanted to get a buzz/high occasionally	143 (44.5)	33 (42.3)
Other reason	90 (28.3)	28 (35.9)
I need to if I miss appointments/pickup	77 (24.2)	20 (25.6)
Drug treatment does not control cravings very well	67 (21.1)	6 (7.7)
I need to when I am travelling	14 (4.4)	4 (5.1)

*The percentages do not add up to 100 as there may be more than one reason for each person. OAT, opioid agonist treatment

shown in Table 2. The odds of diverting OAT were 3.6 times higher among current illicit drug users than among those who did not (95% CI 1.76–7.56; p=0.0005). Of those not taking their full dose of OAT, those reporting side effects as the reason for not taking the full amount of prescribed OAT were the most likely to divert (OR 3.07, 95% CI 1.18–7.94, p=0.021). OAT type was not a significant predictor of diversion in the simple logistic regression (OR for diverting methadone relative to buprenorphine was 1.04, 95% CI 0.63–1.70, p=0.887) (Table 2); in an exploratory analysis (not shown), including OAT medication type in the multivariable model and refitting the final model made little difference to the findings, and OAT type remained non-significant (OR 1.28 95% CI 0.75–2.20, p=0.37). There were no significant interaction terms, either between medication and the main effects found to be significant, or between illicit drug use and terms fitted.

3.3. Analysis of the predictor variables: illicit drug use and failure to take the full dose of prescribed OAT

In the people who reported continued illicit drug use, diversion was reported by approximately 30% of all subgroups: males (93/315, 30%), females (28/90, 31%), daily OAT collectors (27/94, 28.7%), less than daily OAT collectors (93/311, 29.9%), supervised OAT (77/278, 28%), not supervised OAT (44/127, 34.6%), recent prisoners (31/95, 32.6%), not recent prisoners (90/310, 29%).

An exploratory logistic regression analysis (not described) to determine possible predictors of illicit drug use found no statistically significant factors (results not shown). A comparison between those receiving methadone or buprenorphine showed a significant difference in the prevalence of illicit drug use (81.8% vs 68.3%, respectively, p=0.003, Fisher's exact test). The reasons given for using illicit drugs according to prescribed OAT are shown in Table 3. The most common reason given was wanting to get high (44.8%). More people reported that methadone did not control their cravings as a reason for using illicit drugs than buprenorphine (21.1% vs 7.7%, respectively), and this was the only significant factor in logistic regression (p=0.007) (Table 3).

Of all patients (n=505), a higher proportion of methadone users (n=289) than buprenorphine users (n=53) reported taking their full dose every day (72.1% vs 51.0%, p=0.006). In total, 61 people were excluded from this analysis because of an inconsist-

Table 4 Reasons for not taking the full dose given by persons recruited from OAT programmes

Reason given	Methadone (n=71)	Buprenorphine (n=31)
Other	12 (16.9%)	10 (32.3%)
Reduced/no dose	3 (4.2%)	0
Gradually reducing dose	22 (31.0%)	11 (35.5%)
Side effects	5 (7.0%)	3 (9.7%)
No need	16 (22.5%)	4 (12.9%)
No reason given	8 (11.3%)	2 (6.5%)
Reasons 4 + 5	3 (4.2%)	0
Reasons 3 + 5	1 (1.4%)	0
Reasons 2 + 3 +5	1 (1.4%)	0
Reasons 3 + 4 +5	0	1 (3.2%)

OAT, opioid agonist treatment

Table 5 Predictors of acquisition of illicit OAT by persons recruited from OAT programmes (n=505

	Simple logistic regression			Multivariable logistic regression reduced model		
	OR	95% CI	P	OR	95% CI	P
Age (per year)	1.00	0.97–1.02	0.848	-	-	-
Gender						
Female	1 (reference)					
Male	1.11	0.73–1.69	0.619	-	-	-
Prison within last 6 months						
No	1 (reference)					
Yes	1.48	0.94–2.32	0.086	-	-	-
Illicit drug use – no						
No	1 (reference)					
Yes	2.79	1.80–4.33	<0.0001	-	-	-
OAT medication type						
Buprenorphine	1 (reference)					
Methadone	0.85	0.54–1.34	0.479	0.72	0.45–1.18	0.195
OAT dose group			0.710*			
Dose group 5	1 (reference)					
Dose group 1	1.42	0.68–3.00		-	-	-
Dose group 2	1.17	0.58–2.34		-	-	-
Dose group 3	1.22	0.60–2.46		-	-	-
Dose group 4	0.89	0.39–2.02		-	-	-
Frequency of OAT collection			0.536*			
Once per week	1 (reference)					
Daily	1.35	0.80–2.38		-	-	-
2–5 times/week	1.28	0.63–2.62		-	-	-
OAT supervision						
No	1 (reference)					
Yes	1.01	0.69–1.48	0.971	-	-	-
Duration of OAT			0.006*			Illicit drug users
>5 years	1 (reference)			1 (reference)		
<1 year	0.48	0.29–0.81		0.47	0.26–0.84	
1-2 years	0.49	0.29–0.81		0.39	0.22–0.70	
3-5 years	0.61	0.37–1.00		1.00	0.53–1.90	
						Not illicit drug users
>5 years				1 (reference)		
<1 year				0.36	0.10–1.36	
1-2 years				1.04	0.35–3.11	
3-5 years				0.28	0.10–0.79	

* For terms with more than two levels (e.g. dose group), the significance of the predictor overall is presented.; OAT, opioid agonist treatment

ent response to taking their full dose every day but subsequently offering a reason for not taking the full amount (n=41 methadone users and n=20 buprenorphine users). In the comparison between methadone and buprenorphine of the reasons given for not taking the full dose, there was no difference between the two treatments (p=0.08). Conducting the analysis solely on those 102 respondents who reported not taking the full dose every day yielded no evidence of any difference between methadone and buprenorphine users in terms of reasons for not taking full dose (p=0.43) (Table 4).

3.4. Acquisition of OAT by persons recruited from OAT programmes

3.4.1. Prevalence of OAT acquisition

63.6% (95% CI 59.4–67.8%) reported having acquired extra OAT at some point. These patients were being treated with methadone (77.2%, n=251),

Table 6 Acquisition of OAT by persons recruited from NSPs

	All subjects (n=105)	
	n	%
Acquisition of medication in last 3 months [1]		
No	31	29.5%
Yes	74	70.5%
For what reason did you obtain this medication [2]		
Unable to get any heroin	29	39.2%
Did not want to use heroin	28	37.8%
Could not afford heroin	21	28.4%
Help me control cravings	18	24.3%
Wanted to get a buzz/high	10	13.5%
Other reason	5	6.8%
Source 2		
Bought from a friend	37	50.0%
Bought from a dealer	30	40.5%
Given by someone I knew	24	32.4%
Other source	2	2.7%
Medication of choice [2]		
Methadone	48	64.9%
Buprenorphine	26	31.0%
Suboxone	1	1.4%
Reason for medication of choice [2]		
Familiar medicine	48	64.9%
Medicine holds me better	39	52.7%
Easier to obtain	20	27.0%
Like the effect	16	21.6%
Cheaper	14	18.9%
Other reason	3	4.1%

1 Acquisition of OAT was assumed if at least one source was given
2 The percentages may not add up to 100 as there may be more than one reason for each person.
OAT, opioid agonist treatment; NSP, needle and syringe programme

buprenorphine (21.2%, n=69) and Suboxone (1.5%, n=5). Frequency of acquisition was at least once a week in 52.6% of methadone-treated patients and in 44.9% of buprenorphine patients. The main reasons for acquiring extra OAT were given as 'off my script' in 57.8% (n=188) and 'pharmacy closed/missed collection' in 43.4% (n=141).

3.4.2. Predictors of OAT acquisition

Simple logistic regression of individual variables identified continued illicit drug use and duration of prescribed OAT as significant predictors of extra OAT acquisition (Table 5). In the full multivariable model, continued illicit drug use remained highly significant (OR 2.94, 95% CI 1.85–4.68; p<0.0001). Duration of treatment was strongly predictive of acquisition: the longer the duration of OAT, the more likely it was that extra medication was sought (p=0.002). When fitted as part of the full model, OAT type was a significant predictor, with methadone users less likely to obtain extra medication (OR 0.57, 95% CI 0.33–0.98; p=0.04). Neither dose, frequency of collection, nor OAT supervision appeared to have any effect. Whether or not respondents had been in prison was weakly predictive of outcome when fitted alone (OR 1.48, 95% CI 0.94–2.32; p=0.086), with ex-prisoners more likely to obtain extra, but not when all the other terms were included in the model (OR 1.26, 95% CI 0.28–2.04; p=0.340).

There was a significant interaction between illicit drug use and duration of OAT (p=0.026). A reduced model, omitting prison, and including the illicit drug use by duration interaction and OAT type was fitted and is shown in Table 5. The effect of the interaction was that among those using illicit drugs, use of OAT for <3 years decreased the odds of needing to acquire extra medication by approximately 50% relative to those taking OAT for a longer time. OAT type was not a significant predictor in the final reduced model (Table 5). The pattern of duration of medication was less

Table 7 Ease of availability of OAT medications perceived by persons recruited from OAT programmes or by persons recruited from NSPs

Comparison	OR	95% CI		P
Persons recruited from OAT programmes (n=511)				
Methadone tablets	1 (reference)			
Methadone mixture	4.00	3.29	4.87	<0.0001
Buprenorphine	2.63	2.19	3.15	<0.0001
Suboxone	1.08	0.92	1.27	0.331
Methadone mixture	1 (reference)			
Buprenorphine	0.66	0.57	0.76	<0.0001
Persons recruited from NSPs (n=105)				
Methadone tablets	1 (reference)			
Methadone mixture vs methadone tablets	6.00	3.83	9.38	<0.0001
Buprenorphine vs methadone tablets	4.55	2.88	7.18	<0.0001
Suboxone vs methadone tablets	2.10	1.41	3.12	0.0003
Methadone mixture	1 (reference)			
Buprenorphine	0.76	0.51	1.12	0.167

OR = odds ratio; SE, standard error; CI, confidence interval; OAT, opioid agonist treatment; NSP, needle and syringe programme

clear among non-users of illicit drugs but the numbers were relatively small.

3.5. Acquisition of OAT by persons accessing NSPs

3.5.1 Prevalence of OAT acquisition

Of the 105 participants, 70.5% (95% CI, 61.8 to 79.2%) had acquired OST in the last 3 months, which had been bought in 90.5% of cases (n=67). The reasons given are shown in Table 6. Of those acquiring medication, significantly more acquired methadone than buprenorphine (64% vs. 35%, p=0.0005, Fisher's exact test).

3.6. Perceptions of the availability of illicit OAT in persons recruited from OAT programmes and persons accessing NSPs

Methadone mixture was perceived to be more readily available than methadone tablets by both groups (persons recruited from OAT programmes and persons accessing NSPs) (Table 7). Buprenorphine was perceived as more difficult to obtain than methadone mixture, significantly so among persons recruited from OAT programmes (OR 0.66, 95% CI 0.57–0.76 p<0.0001) (Table 7). There was less awareness of Suboxone, with a higher proportion of respondents in both groups (OAT programme users and NSPs) who did not know how easy or difficult it was to source (**Figure 1** shows the distribution of responses for each treatment).

4. Discussion

In this large survey conducted in a substantial urban area in the UK where methadone was the predominant OAT and levels of dose supervision were high, we found that 32.5% (95% CI 28.4–36.6) of participants recruited from OAT programmes self-reported diverting their methadone or buprenorphine at some point in time and when asked about their current actions, the prevalence of OAT diversion was 25.2% (95% CI 28.4–36.6). Our findings are similar to those of the recent 'European Quality Audit of Opioid Treatment' (EQUATOR) [9], and a recent Swedish survey [13], and closely align with the findings of the recent systematic review [1]. EQUATOR was a combined analysis of survey data collected from 3,888 individuals (heroin users—in and out of treatment—and physicians who provide medication-assisted therapy) in 10 European countries and is the largest reported multinational European evaluation of opioid dependence treatment [9]. EQUATOR found that 30% of UK participants who were treated predominantly with methadone admitted they had diverted their medication at some point. The Swedish survey conducted in 411 patients found that 24.1% had diverted part of their OAT in the last month [13].

We found the main predictor of whether OAT was diverted (either sold or given away) was whether the participant was still using illicit drugs: the odds of diverting medication were 3.6 times higher among illicit drug users than among those who did not (95% CI 1.76 to 7.56). The Swedish survey described simi-

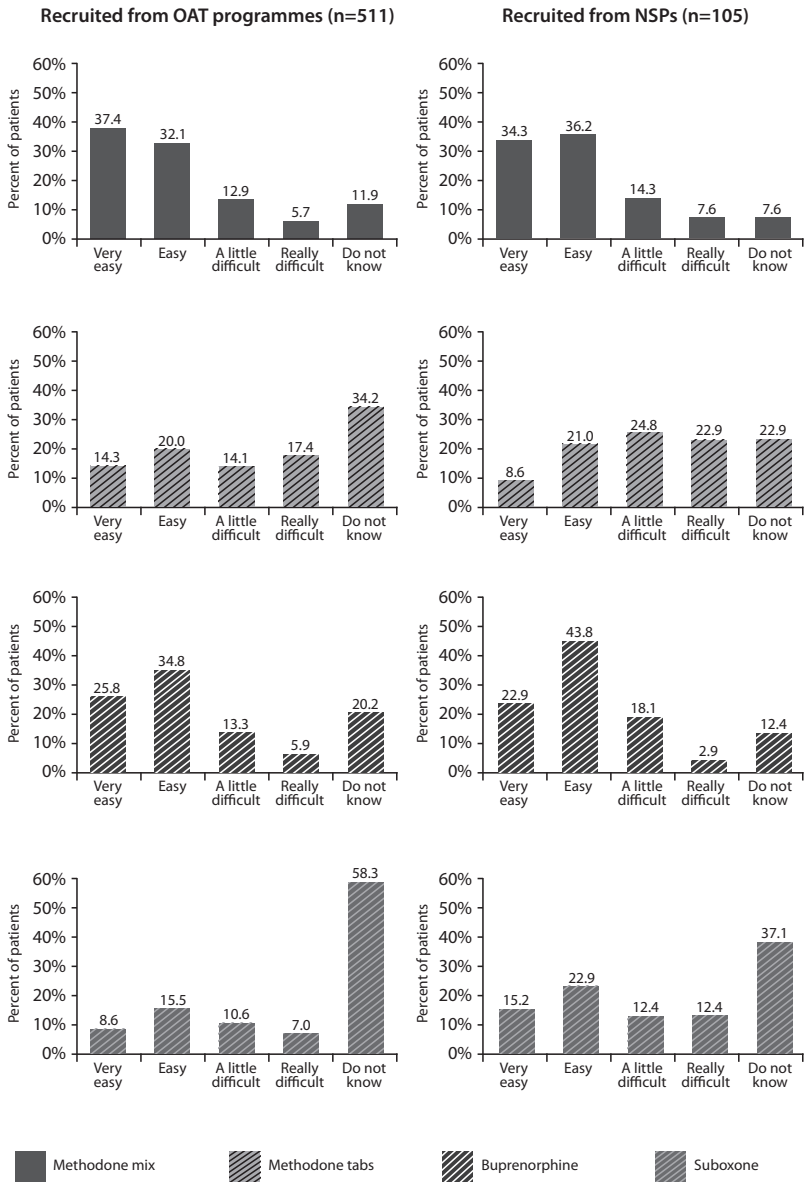

Figure 1. Perceived availability of OAT medication for purchase in the community

lar logistic regression analysis and also found that the main risk factor for diversion is continued illicit drug use [13]. Few factors associated with diversion have been reported previously, but buprenorphine would appear to have a higher risk than methadone, both in previous studies [14, 15] and the Swedish survey [13]. Our findings do not support this difference, with no treatment effect found in the logistic regression model between the two OAT treatments. Diversion was unaffected by supervision of OAT treatment, or by the frequency of collection (grouped as daily, 2–5 times per week and once a week). Of interest, of those reporting supervised consumption of OAT, 82% reported taking the full dose every day; this highlights that 18% of people with supervised consumption failed to take the full dose and raises questions about why—does this reflect poor quality supervision, or is there an issue around UK practice at weekends? Weekend home-dosing is common in the UK. OAT is dispensed primarily via the community pharmacy network. Whilst some pharmacies open seven days a week, the majority do not, resulting in some doses (usually Sundays) not being supervised in the pharmacy, instead being provided as take-home doses on the day immediately prior to non-trading days. What is clear is that, whilst supervision is an important

safeguard, it is not an absolute deterrent to diversion. This may be of concern in the face of the abundance of reports that reflect on the benefits of tightened constraints when prescribing OAT, such as the potential to reduce opioid overdoses [3,22]. However, some have argued that better outcomes can be achieved with a more flexible approach to the use of supervised consumption [6, 10].

We found no apparent pattern among illicit drug users to determine who might be more likely to divert their medication, with rates of diversion similar among all subgroups of people who continued to use illicit drugs. However, methadone users were significantly more likely to report continued use of illicit drugs than buprenorphine users and failure of OAT to control cravings was more frequently reported by methadone users than by buprenorphine users to explain illicit drug use (OR=3.33, p-0.007). Given that the average dose of methadone prescribed was 52.6 mg, one cannot help but reflect on the importance of getting the basics right in terms of appropriate dosing. There was also evidence of under-dosing of buprenorphine, with only about one third of people receiving 12 mg or more of buprenorphine and a mean dose of 10.5 mg. However, it is important to consider that some people would have been on a structured reduction of their OAT and this did not form part of the questionnaire. Nonetheless, the responses do indicate that sub-optimal dosing is a risk factor for diversion.

Looking at the reasons reported by participants for not taking the full dose of OAT prescribed, as might be expected participants citing any of the reasons given (apart from 'reduced dose/no dose on days that I use') were more likely to divert their medication than not. Those reporting that side effects from OAT (such as nausea, constipation, sweating, reduced sexual function for example) were the reason for not taking the full amount of OAT prescribed were the most likely to divert—the odds of diverting medication among those who did not take the full amount prescribed were about 3 times the odds for those where side effects did not affect the amount taken. Regular questioning and documentation of clients' side-effect profile and consideration of alternative treatments in those for whom OAT is causing problems is a simple step that may reduce diversion.

We also investigated self-reported acquisition of OAT by persons recruited from OAT programmes and those accessing NSPs and not in receipt of a current OAT prescription. For both groups, acquisition rates were high—63.6% (95% CI, 59.4–67.8) and 70.5% (95% CI, 61.8–79.2) respectively. These findings align closely with those of a survey of methadone diversion on Merseyside, UK, which reported 60% of participants recruited both in and out of prescribing agencies had obtained illicit methadone in the last year [8].

The primary motivation for diverting OAT has not been well characterised in the past. In the Merseyside survey, most methadone diversion took place between friends and associates, rather than a dealer network [8]. Others have suggested the concept of a 'moral economy' existing between opioid users [10, 11]. The recent Swedish survey found that the norm system among their patients most closely resembled a 'moral economy of sharing', with patients suggesting it was 'unethical' not to share their medication with friends in withdrawal [14]. We found a similar pattern with both methadone and buprenorphine. In those asked if they had ever diverted their OAT, almost all reported the apparently altruistic reason of diverting to help others to treat withdrawal. For those asked about their current OAT and reporting diversion, most reported giving the medication away, but more than one third (34%) reported both giving it away and selling for money.

In order to determine which factors led to acquisition of extra medication, logistic regression was again used. Again continued illicit drug use, and in this analysis, duration of OAT, were significant. Thus, continued illicit drug use and long duration OAT are the main predictors of whether extra OAT was ever acquired. Although the trend was for less extra medication obtained with methadone than with buprenorphine, and more extra medication obtained among ex-prisoners, neither effect was statistically significant. One might expect that the longer the length of treatment, the greater the opportunity to divert OAT. However, it could be hypothesized that one possible reason for length of treatment being a significant factor is that people who have been stable in treatment for a long period of time are more likely to source illicit OAT than revert to heroin use if their licit supply is interrupted. Further research would be needed to clarify this theory.

For the NSP respondents, the findings were different to those in a treatment programme. Significantly more reported acquiring methadone than buprenorphine, which aligns with the primary reason given for acquiring their 'medication of choice', which was familiarity; few described the effect of the drug as the reason. For this group, the majority of OAT was purchased rather than received from an associate. For more than one third of these patients, the primary

reason given was to avoid using heroin, suggesting self-treatment.

As expected, both the OAT programme users and the NSP respondents perceived methadone mixture to be much more readily available illicitly than methadone tablets, with odds ratios of 4 and 6 respectively. This is unsurprising given that methadone tablet prescribing is not recommended [7]. Buprenorphine was seen as slightly harder to source than methadone mixture, especially in the main survey group. Given the ratio of prescribing of these two drugs, this is perhaps unsurprising. For Suboxone the picture was less clear. Awareness of Suboxone among the main group was lower than in the NSP group and there appeared to be little difference in terms of the perception of ease of availability to that of methadone tablets among those respondents. Among the NSP users, however, where the awareness of Suboxone was greater, it was perceived as more difficult to obtain than either methadone mixture or buprenorphine. Suboxone has been shown to be diverted less than buprenorphine in OAT treatment programmes [15]; the combination with the opiate antagonist naloxone, which when injected or taken in high doses can block the effect of the opioid and precipitate withdrawal, reduces the risk for misuse. However, given that the level of buprenorphine injecting is negligible in Birmingham, Suboxone is not recommended in local prescribing guidelines, as it is not perceived to add any extra benefits for the additional cost over buprenorphine and methadone. As such, the relative lack of awareness is not unexpected.

Strengths of the study are that it was conducted across multiple sites across an area of three different clinical commissioning groups but with a single care provider for addictions services. The characteristics of those enrolled appear to align with other surveys—predominantly males, mostly on daily pick-up, most on methadone and about half in long-term (5 years or more) treatment. The survey has limitations. Whilst the protocol and questionnaire were designed to protect anonymity, the data collected was self-reported and so the possibility of under-reporting of diversion is present. As a result of how we recruited the participants, we have no insight into the potential for non-participation bias. The research team provided our questionnaires and facilitated the process of data collection; this may be a limitation as the recent Swedish survey found that peer interviewers found significantly higher rates of diversion than members of the research team [13]. In retrospect, several of the questions could have been worded better, in particular questions that contained two questions. In addition, we did not include recruitment location as a potential predict in the logistic regression. This was excluded because the four sites were within the same City and were operated by the same service provider. However, it is conceivable that there could have been a treatment effect linked to the different sites. With regard to understanding better the risk factors for illicit drug use, more detailed questioning around socialising and contact with other illicit drug users may have yielded more insights, as it did in the Swedish survey [13]. In addition, it would have been valuable to understand the degree that psychosocial interventions were being used and if a lack of these interventions in any way increased the risk of illicit drug use and diversion. Finally, the survey did not ask about the routes of ingestion of diverted OAT, which may have given further insights into approaches to reduce OAT diversion.

5. Conclusions

Rates of diversion and acquisition of OAT were high but in keeping with recent European studies and were largely for altruistic reasons. There was no difference in the diversion liability of buprenorphine compared with methadone in this UK setting. Continued illicit drug use was the main risk factor for diversion and side effects that caused clients not to take full-dose OAT predicted diversion. High levels of supervision and daily pick-up do not seem to stop diversion, and whilst such controls have value they should not be relied upon as absolute deterrents with respect to diversion. Acquisition of OAT by those currently in treatment was related to continued illicit drug use and long-duration OAT therapy. There were very high levels of diverted OAT use in those outside treatment programmes with significantly more methadone acquired than buprenorphine. These predictors offer important clues to OAT service improvement and point to the importance of optimised OAT with awareness of diversion potential, side effect profile, and effective supervision as a means of reducing OAT diversion.

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Contributors

All authors were involved in the study design, had full access to the survey data and analyses, and interpreted the data, critically reviewed the manuscript and had full control, including final responsibility for the decision to submit the paper for publication.

Conflict of interest

The authors declare that there is no conflict of interest.

Ethics

Authors confirm that the submitted study was conducted according to the WMA Declaration of Helsinki - Ethical Principles for Medical Research Involving Human Subjects. The study have IRB review/approval.

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