

Regular article

Outcome of heroin-dependent adolescents presenting for opiate substitution treatment

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Abstract

Because the outcome of methadone and buprenorphine substitution treatment in adolescents is unclear, we completed a retrospective cohort study of 100 consecutive heroin-dependent adolescents who sought these treatments over an 8-year recruitment period. The participants' average age was 16.6 years, and 54 were female. Half of the patient group remained in treatment for over 1 year. Among those still in treatment at 12 months, 39% demonstrated abstinence from heroin. The final route of departure from the treatment program was via planned detox for 22%, dropout for 32%, and imprisonment for 8%. The remaining 39% were transferred elsewhere for ongoing opiate substitution treatment after a median period of 23 months of treatment. Males were more likely to exit via imprisonment ($p < .05$), but other outcomes were not predicted by gender. There were no deaths during treatment among these 100 patients who had a cumulative period of 129 person years at risk. Our findings suggest that this treatment delivers reductions in heroin use and that one fifth of patients will exit treatment following detox completion within a 1- to 2-year time frame. © 2012 Elsevier Inc. All rights reserved.

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1. Introduction

Substitution treatment with agonist medications, such as methadone and buprenorphine, represents the treatment of choice for heroin-dependent patients (NICE, 2007). The evaluations of methadone maintenance treatment (MMT) indicate that it reduces mortality, HIV-related injecting risk behavior, illicit heroin use, and criminal activity (Marsch, 1998; Marsden et al., 2009). Nevertheless, it is still surrounded by substantial political controversy, and there is much legislation in many jurisdictions imposing limits on who can and cannot receive opiate substitution treatment (Fudala & Woody, 2004).

Internationally, adolescent presentation to opioid treatment facilities is uncommon. In the United States, 1% of treatment episodes in adolescents in 2007 related to heroin abuse (SAMHSA, 2009). In Britain, 3% of treatment episodes in this age range in 2008–2009 were precipitated by opiate abuse (NTA, 2009). Ireland witnessed a dramatic increase in heroin abuse during the mid-1990s in Dublin, with adolescents accounting for 13% of all heroin-related treatment attendances during that decade (Smyth & O'Brien, 2004). As in Britain, the prevalence of heroin dependence in teenagers has diminished in recent years, with adolescents accounting for just 1% of heroin-related addiction treatment episodes in 2007 (Carew, Bellerose, Lyons, & Long, 2009). Opioid-dependent patients in the United States frequently present with abuse of prescription opioids (Motamed, Marsch, Solhkhah, Bickel, & Badger, 2008; Gonzales, Brecht, Mooney, & Rawson, 2011). This is uncommon in Ireland (Carew et al., 2009).

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There is an absence of comprehensive international guidelines on use of opiate substitution treatment in adolescents. Guidelines from the United States and Canada indicate that opiate substitution treatment should not be offered to adolescents unless they have previously failed a detoxification-based treatment intervention (Center for Substance Abuse Treatment, 2005; College of Physicians & Surgeons of Ontario, 2005). SAMHSA (2009) has suggested that opiate agonist treatments are possibly underutilized in this age group in the United States, with just 3% of adolescent heroin admissions having such treatment as part of their care plan in 2007. In Britain, the Department of Health (2009) recently produced consensus guidelines on pharmacological treatments in addiction for adolescents, acknowledging a role for opiate agonist medications in this age range.

Although thoroughly evaluated in adults, there has been surprisingly little research conducted on the outcomes of adolescents who receive this treatment (Fudala & Woody, 2004; Hopfer, Khuri, Crowley, & Hooks, 2002; Kaminer & Marsch, 2011). There have been no large-scale studies of methadone maintenance in adolescents since the 1970s. Millman, Khuri, and Nyswander (1978) reported outcome from their MMT program for 153 heroin-dependent adolescents in New York in the 1970s. They found that 29% exited via planned detoxification, 21% either dropped out or faced a disciplinary discharge, and 44% remained on MMT or were transferred elsewhere for ongoing treatment. Three percent died, and 3% went to prison. The Drug Abuse Reporting Program study was also conducted in the United States, and Sells and Simpson (1979) reported outcome in a large subset of young people less than 20 years of age. They found reductions in heroin use in all treatment modalities and that MMT demonstrated better treatment retention than other treatment options. However, those who were retained in therapeutic community treatments did better than those retained in MMT in terms of occupational outcomes. Although these studies provide some evidence of the effectiveness of methadone treatment in this age range, the findings may not generalize to modern cohorts of heroin-dependent adolescents. In the intervening decades, awareness of HIV risks has occurred, misuse of prescription opiates has increased, and alternative agonist treatments such as buprenorphine have become more widely used. These and other factors may have altered the patient profile, treatment provision, and recovery context substantially in the past 35 years.

Minozzi, Amato, and Davoli (2009) completed a recent Cochrane review of opiate substitution treatment in adolescents but identified just two clinical trials in total (Lehman, 1973; Woody et al., 2008). The Lehman study compared LAAM to methadone but involved treatment of just 4 months and was judged to be “of very low quality,” so no conclusions could be reached. Although the Woody et al. (2008) study was well designed and it examined buprenorphine treatment, it compared a 2-week detox treatment

against an extended 9-week treatment, which then also ended in a detox. The treatment participants were generally young adults, with just 17% being younger than 18 years. They reported reductions in opioid use and better treatment retention during the very brief maintenance phase of treatment, but both groups tended to quickly relapse following cessation of buprenorphine treatment. Therefore, this Cochrane review reveals very little about the outcome of sustained maintenance treatment in adolescents less than the age of 18 years.

Since the 1970s, there have been a small number of relevant descriptive studies. Crome, Christian, and Green (2000) reported on the outcome of the first 48 patients with severe heroin dependence who were prescribed methadone at a youth treatment service in England. It was reported that 80% were retained in treatment and that 37% had a “good” outcome, but the criteria used to determine the outcome were subjective and somewhat unclear. A more recent Australian study highlighted the challenges of retaining this patient group in treatment (Bell & Mutch, 2006). From the cohort of 61 teenagers, two thirds dropped out of their index treatment episode. Among those who left treatment, following either detoxification or dropout, 62% subsequently reaccessed treatment.

The absence of recent relevant outcome research for this patient group means that there has been very little to guide clinicians, treatment commissioners, patients, or parents about what to expect following commencement of an adolescent on opiate substitution treatment. We sought to address this gap in the scientific literature by providing a descriptive analysis of the experience of heroin-dependent adolescents entering a substitution treatment program over an 8-year period. We also sought to examine incidence of hepatitis C, HIV, and mortality among adolescents who commenced this treatment.

2. Method

2.1. Setting

In 2000, because of the large number of opiate-dependent adolescents presenting to treatment services in Dublin and the growing recognition that their treatment needs differed to that of the adult population, the Young Persons Program (YPP) was developed at the Drug Treatment Centre Board (DTCB). It provided a multidisciplinary adolescent treatment service, working in a manner that was broadly consistent with the recent British guidelines (Department of Health, 2009). The team was led by consultant child and adolescent psychiatrists and had input from nursing, clinical psychology, social work, project workers, counselors, and family therapy. The staff-to-patient ratio was over double that which existed in the adult MMT programs in DTCB. The YPP was based in central Dublin and provided treatment to opiate-dependent teenagers from all of Dublin and the

surrounding counties. Patients travelled up to 50 miles to attend the service.

Methadone prescribers are specifically regulated by legislation in Ireland (Bulter, 2002). General practitioners (GPs), or office-based practitioners, are not permitted to initiate any patient onto methadone unless they have undergone substantial training, and all patients must be registered with the Central Treatment List (CTL). National guidelines on the treatment of addiction in adolescents emphasize the need for multidisciplinary input into treatment (Dept of Health & Children, 2005). Consequently, GPs or office-based practitioners rarely prescribe methadone to heroin-dependent adolescents. During the period of this study, only doctors working at the DTCB were permitted to prescribe buprenorphine in Ireland. In 2011, access to buprenorphine remains restricted to a small number of specialist addiction clinics in Dublin.

Patients were expected to be 17 years or younger when they commence assessment on the YPP, although 18-year-olds were occasionally accepted. There was an expectation that patients progress from the service prior to their 20th birthday. If there was a need for ongoing opiate substitution treatment, they were facilitated with a planned transfer to an adult addiction service.

2.2. Assessment

There was an open referral system to the YPP, with family and social workers being the most common sources of referral. There was no waiting list. There were no exclusion criteria for opiate-dependent patients, although patients who were deemed to need acute inpatient treatment of a co-occurring medical or psychiatric disorder had their assessment postponed until this disorder was stabilized. Treatment was provided free of charge. Assessment occurred over a 7- to 10-day period, during which patients typically attended on three occasions to meet different members of the multidisciplinary team. In addition to being assessed for heroin dependence using the *International Classification of Diseases, 10th Revision* criteria, patients also provided three supervised urine samples as confirmatory evidence of regular heroin use. Assessment also sought to identify coexisting psychological, developmental, social, and physical needs.

People 16 years and older may consent to medical treatment on their own behalf in Ireland (Dept of Health & Children, 2005). However, we also sought parental agreement to treatment in these cases. Parental consent was required for patients younger than 16 years. The main pillars of treatment involved opiate substitution medication (methadone or buprenorphine), counseling (cognitive-behavioral therapy, motivational interviewing, or humanistic person-centered therapy), and family therapy in some cases. Although patients were expected to attend counseling sessions on a weekly basis, failure to do so did not result in termination of treatment. In practice, it was our

experience that about 50% of patients availed of individual counseling sessions per week. There were group activities during afternoons, using art therapy and delivery of life skills. Attendance at groups was encouraged but not compulsory. Participation rates at groups were typically 40% to 60%.

2.3. Approach to opiate substitution treatment

Induction onto methadone typically commenced with a dose of 20 mg on Day 1. Dose was then increased by 10 mg every 2 to 4 days, titrated against withdrawal symptoms, cravings, and ongoing heroin use while also monitoring for evidence of sedation. Stabilization doses were generally in the region between 40 and 70 mg. Although this was lower than stabilization doses typically recommended for adults, patients at the lower end of the dose spectrum had a personal preference for a relatively low dose and achieved stabilization (i.e., absence of withdrawal symptoms, control of cravings, and heroin abstinence) on this dose.

Buprenorphine became available as a treatment option in 2005, initially as the sublingual mono buprenorphine tablets (Subutex, Reckitt Benckiser Healthcare [UK] Ltd). In 2007, we switched to use of the buprenorphine–naloxone combined preparation Suboxone (Reckitt Benckiser Healthcare [UK] Ltd). Induction usually involved provision of 2 mg buprenorphine during the morning of Day 1, with a further 2 to 6 mg later that afternoon. Single daily doses of up to 8 to 12 mg were administered from Day 2. Stabilization doses were typically in the region of 6 to 12 mg. Consistent with the recent guidelines on opiate substitution treatment, buprenorphine was offered where patients had shorter heroin use histories and were striving toward detox on the short to medium term (Kaminer & Marsch, 2011; NICE, 2007; SAMHSA, 2009). We found that about 40% of patients were unwilling to agree to buprenorphine treatment when it was recommended by the clinical team. In such cases, we then offered methadone.

Although published after this study, our approach to medication induction and stabilization for these adolescent patients was consistent with that outlined in the recent British treatment guidelines on this topic (Department of Health, 2009).

If patients continued to use heroin or resumed use after a period of abstinence, an increase in dose of opiate substitution treatment was considered. They were also encouraged to participate in increased counseling sessions with a focus on functional analysis of drug use episodes and on relapse prevention skills (McKay, 2009). Where initial opiate substitution treatment option was associated with a poor treatment response, the patient was offered the option of switching to the alternative. If heroin use persisted despite these treatment changes, consideration was given to arranging transfer to the adult maintenance program.

Patients provided two supervised urine samples per week for drug toxicology during treatment. These samples were screened for opiates, EDDP (a methadone metabolite), cocaine, amphetamines, cannabis, benzodiazepines, and alcohol. The provision of “takeaway” doses of medication was used as a contingent reinforcer of opiate abstinence, as evidenced by urine toxicology. As patients established a period of opiate abstinence, they incrementally earned increased takeaway doses of medication. After 2 weeks of heroin abstinence, they received one takeaway dose, typically on a Saturday or Sunday. Once they attained a period of 4 weeks of abstinence, they obtained a second takeaway dose. A subsequent lapse to heroin use resulted in an immediate loss of one of their takeaway doses. Ongoing heroin use resulted in loss of all takeaways. Patients were also provided with treatment of comorbid physical or psychiatric problems. They were actively supported in addressing coexisting housing, vocational, and criminal justice-related needs as part of their care plan. If they obtained work or training or accessed education, they were provided with takeaway doses of medication to facilitate their participation in same. Such patients typically attended the program just 1 or 2 days per week, receiving takeaways for the remaining days.

We wished to avoid disciplinary discharges and only considered this option where patients were seriously jeopardizing the safety of other patients via drug dealing on the premises and actual acts of violence toward others. Where patients presented with high levels of aggression, transfer to the adult treatment service was considered.

The service was harm reduction orientated. Nevertheless, it held an aspiration, but not an insistence, that all patients progress toward complete abstinence via detoxification. Prior to detoxification, patients typically spend a number of months stabilizing on opiate substitution treatment, during which time they are expected to cease abuse of heroin and other drugs, while also addressing the coexisting psychological and social problems that might leave them vulnerable to relapse. Where detox, or dose tapering, occurred, it was generally conducted slowly on an outpatient basis over a period of about 3 months, negotiated with the individual patient. If the patient returned to heroin use during a detox, it was recommended that detox halt temporarily or else revert to a further period on a stabilization dose. Where patients insisted on finishing a detox and leaving treatment despite evidence from urinalysis of ongoing heroin use, they were viewed as treatment dropouts. Patients had the option of referral to a residential specialist addiction treatment unit, under the care of the consultant child and adolescent psychiatrist, to commence and complete detox. In practice, about one third of the patients who complete detoxification use this latter option. Following detox, the YPP either provided ongoing psychological support or facilitated the patient in accessing same at an alternative, more locally accessible service. Where patients relapsed

following detox, we strived to promptly reengage them back into treatment.

2.4. Patients

Although the YPP accepted referrals on young people who were opioid dependent, in this study, we focused on heroin users specifically. We included all patients who were heroin dependent, who were treated with opiate substitution medication, and who initiated treatment after the YPP was opened in May 2000. Patients with a primary diagnosis of dependence on prescription opioids were excluded. Patients who dropped out of the assessment process before commencing medication were not included. We included the first 100 consecutive patients who met these criteria, and we reached this number of recruits in July 2008. The end point for data collection on treatment outcome for each patient was the point at which they last exited treatment on the YPP or July 2009, whichever was earlier.

2.5. Data collection

The study received ethical approval from the Ethics Committee of the DTCB. Baseline descriptive characteristics were obtained from the patients' initial structured assessment, this being adapted from the Maudsley Addiction Profile (Marsden et al., 1998). The assessment was administered by the YPP staff. We recorded information on patient treatment participation 3, 6, and 12 months after commencement on opiate substitution treatment. If a patient was not attending the service on these dates, we noted the date of and reason for exit. For patients in treatment on or after 12 months we recorded the final route of exit from the YPP and the date of same.

The primary outcome of interest in this study was the final progression routes of patients. We categorized all patients into one of four different progression routes. Those who were referred to and commenced on another opiate substitution treatment program were categorized as “transfers for ongoing treatment.” Patients were categorized as exiting via detox if they completed the prescribed detox regime and showed urinalysis evidence of opiate abstinence at discharge from the treatment program. Patients who ended treatment because they were incarcerated were categorized as exiting due to prison. Finally, patients who simply stopped attending, relocated without arranging alternative treatment, or left treatment prematurely against medical advice were all categorized as being dropouts.

To examine mortality, we used the dates of treatment entry and final departure from the YPP to calculate person years at risk (PYAR). For patients who exited the service within 12 months, we sought to confirm that they were alive at 12 months by contacting them, the local treatment services, or the other professionals involved in their care.

For patients still in treatment at 1 year, we examined their success in avoiding heroin use by using the results of their

twice-weekly urinalysis during their 12th month of treatment. For patients who had progressed out of treatment within 12 months, we did not seek to obtain information on their current drug use.

Viral serology was offered during the first few weeks of treatment. We screened for antibodies to HIV and hepatitis C using enzyme-linked immunosorbent assays. Those with baseline negative results were offered repeat screens, about every 9 to 12 months.

We reviewed records of all patients who presented for assessment to the YPP to identify those people who were heroin dependent, or probably heroin dependent, and began assessment for opiate substitution treatment but did not commence same. We gathered this information to determine the proportion of patients who dropped out of the assessment process.

Because the YPP was not the only provider of opiate substitution treatment to adolescents in Dublin or the surrounding counties during this period, we obtained information from the CTL on all people from this region less than 18 years of age who were commenced on methadone during the study period. We obtained this information to better characterize treatment provision in Dublin and also to examine how representative the YPP study group was of the wider adolescent group in treatment in the Dublin region. In order to adhere to data protection guidelines, we received a breakdown of such patients by age and by gender. Information was provided on the number of distinct individuals who commenced treatment in each separate service. However, it was not possible to determine how many of these individuals received treatment also on the YPP or in other settings. For example, if an individual patient reaccessed treatment in the one service on three occasions, they featured only once in the CTL dataset provided. However, if they received treatment in three separate services, they featured three times in the dataset.

2.6. Statistics

We compared baseline characteristics and treatment progression route by gender. We used Pearson's chi-square test to explore association between categorical variable and gender, except in instances where a predicted cell value was less than 5, where Fisher's exact test was used. For continuous variables, we conducted the independent samples *t* test.

When calculating the incidence of viral infection, the date of the first negative test represented the starting point for all patients when calculating their PYAR. The end point was the date of the last negative test for those who remained seronegative. The estimated date of seroconversion was used as the end point for those who seroconverted, and this was calculated by finding the midpoint between their most recent negative test and their first positive. The 95% confidence interval (CI) was calculated by using the exact CIs for binomial proportions.

3. Results

3.1. Patient profile

During the recruitment period, only 1 patient was excluded due to the fact that he was primarily dependent on methadone, which he purchased illicitly, and he denied ever using heroin. No patient presented with primary dependence on other prescription opioid medications. There were a further 20 patients who presented with probable or definite heroin dependence, began assessment for treatment, but did not commence opiate substitution treatment on the YPP. Of these, 2 were redirected to inpatient treatment, and 2 were redirected to a more accessible local outpatient service. Four were incarcerated while attending for assessment, and 12 either dropped out or opted not to pursue treatment. Although those who commenced assessment but did not start treatment on the YPP were no different in age from those who commenced treatment, they were more likely to be male (odds ratio 3.3, $p = .03$).

Of the 100 patients commenced on opiate substitution treatment on the YPP included in this study, 54 were female, and 88 were 17 years or younger at treatment commencement. There were 13 patients aged less than 16 years.

From the CTL, it emerged that there were 117 treatment episodes involving methadone treatment of a person 17 years and younger at other outpatient services in the region during this 8-year period. These treatment episodes are not reported in this study. Because the information provided by the CTL relates to treatment episodes, we do not know how many of these episodes relate to people who were also treated in the YPP. Seventy of these treatment episodes were conducted at one of the four other dedicated youth treatment programs that existed in Dublin during this period. Nine episodes were initiated by GPs, and the remaining 38 episodes occurred at adult treatment clinics. The mean age of the patients involved in these other 117 treatment episodes was 16.7 years ($SD = 0.7$), and 48% were female, these characteristics being very similar to the YPP cohort described in this study.

The sociodemographic, clinical, and treatment characteristics of the YPP patient group are reported in Table 1, in which gender differences are also highlighted. Males were more likely than females to present with a history of previous convictions, imprisonment, early school leaving, and opiate abuse by a sibling. Females were more likely to be in a relationship with another heroin user and to have a history of deliberate self-harm.

3.2. Opiate substitution treatment

Nineteen were prescribed buprenorphine and the others received methadone at treatment commencement. We examined the methadone dose for each patient in treatment after 3, 6, and 12 months. Where patients were on methadone

Table 1
 Characteristics of 100 adolescents presenting for opiate substitution treatment, by gender

Characteristic	Total group		Males (n = 46)		Females (n = 54)		p ^a
	n (%)	M (SD)	n (%)	M (SD)	n (%)	M (SD)	
Demographics, supports, and criminality							
Age in years		16.6 (0.9)		16.6 (0.8)		16.6 (1.0)	ns
Age last attended education		14.4 (1.6)		13.8 (1.8)		14.9 (1.2)	.002
In school or training	11 (11)		6 (11)		5 (11)		ns
Two parent family support	53 (54)		21 (46)		32 (60)		ns
Parental alcohol abuse	55 (60)		25 (60)		30 (60)		ns
Sibling opiate abuse	41 (43)		25 (56)		17 (32)		.02
Ever in care	29 (30)		17 (38)		12 (23)		ns
Homeless in past month	30 (30)		14 (30)		16 (30)		ns
Previous criminal convictions	40 (43)		26 (59)		14 (29)		.004
Ever incarcerated	25 (27)		18 (41)		7 (14)		.004
Current boyfriend/girlfriend using heroin	41 (42)		7 (16)		34 (64)		<.001
Psychiatric history							
Ever seen a psychiatrist	49 (50)		25 (56)		24 (45)		ns
History of deliberate self harm	29 (30)		8 (18)		21 (41)		.01
Substance use							
Age of first heroin use		14.7 (1.3)		14.6 (1.6)		14.7 (1.1)	ns
Months of regular heroin use		16.5 (11.5)		18.3 (12.3)		14.9 (10.8)	ns
No. of "bags" of heroin per day		3.5 (1.8)		3.6 (1.9)		3.5 (1.8)	ns
Past month drug use							
Benzodiazepine misuse	54 (55)		26 (57)		28 (54)		ns
Use of black market methadone	50 (53)		25 (57)		25 (49)		ns
Cocaine use	18 (19)		9 (20)		9 (18)		ns
Ever injected	46 (47)		23 (51)		23 (43)		ns
Hepatitis C testing							
Untested for HCV	16 (16)		8 (17)		8 (15)		ns
HCV antibody positive at baseline ^b	17 (20)		8 (21)		9 (20)		ns
Initial treatment with buprenorphine	19 (19)		9 (20)		10 (19)		ns
Treatment duration							
Months in contact with treatment service ^c		14.5 (12.1)		13.4 (12.0)		15.4 (12.3)	ns
Still in treatment at 12 months	50 (50)		19 (41)		31 (57)		ns
Heroin use during the 12th month of treatment ^d							
Constant use	7 (14)		4 (22)		3 (10)		ns
Intermittent use	23 (47)		9 (50)		14 (45)		ns
Abstinent	19 (39)		5 (28)		14 (45)		ns
Route of discharge among 92 patients who finished treatment							
Dropped out	29 (32)		14 (33)		15 (31)		ns
Transferred for ongoing treatment	36 (39)		16 (37)		20 (41)		ns
Planned discharge after detox completion	20 (22)		7 (16)		13 (27)		ns
Prison	7 (8)		6 (14)		1 (2)		.05 ^e

Note. ns = not significant.

^a The reported test statistic is the chi-square value for categorical variable and Student's *t* test statistic for quantitative variables.

^b Proportion HCV antibody positive in initial HCV screen, among those tested for same.

^c This represents the number of months from first commencing treatment to final departure from the service.

^d Heroin use determined via urinalysis. "Constant use" implies all urine drug screens were opiate-positive; "intermittent use" implies some, but not all, urine drug screens were opiate-positive; and "abstinent" implies all urine drug screens were opiate negative.

^e *P* value was calculated using Fishers exact test statistic, as estimated value in cell was less than 5.

treatment at more than one of these time points, we noted the highest or peak methadone dose for each individual. The mean peak dose was 53 mg (range = 15–90 mg). Of those initiated on buprenorphine, during the first 3 months on the YPP, eight patients had a planned discharge following detox completion, five had dropped out, and four had switched to methadone treatment. Only two people remained on this medication at 3 months (doses 4 and 12 mg). At 6 and 12 months, there was only one patient on buprenorphine at each occasion (doses 8 and 6 mg, respectively).

3.3. Treatment outcome

Table 2 highlights patients' progression out of and back into treatment. Of the 28 people who dropped out during the first year of treatment, 19 left during the first 3 months. Five of those very early dropouts subsequently returned to the YPP. Although 21 people exited treatment following detox completion during the first 6 months of treatment, 12 of these subsequently returned back into treatment in the YPP following a relapse.

Table 2
Progression routes of 100 heroin-dependent adolescents following initiation on OST

Variable	Months 1 to 3	Months 4 to 6	Months 7 to 12	Months 13 and thereafter
No. of departures from treatment during this period via:				
Detox completion	13	8	6	6
Dropout	19	1	8	5
Imprisonment	3	1	2	3
Transferred to adult service for ongoing OST	2	2	1	29
Transferred to another adolescent service for ongoing OST	0	2	0	0
Disciplinary discharge	0	0	0	1
Total exits during this period	37	14	17	44
No. of returns back into treatment during this period, having previously exited via:				
Detox		3	9	1
Dropout		3	2	0
Imprisonment		0	1	1
Total returns during this period	0	6	12	2
Total number in treatment at the end of this period	63	55	50	8 ^a

Note. OST = opiate substitution treatment.

^a Recruitment into study ended in July 2008. Patients' progression was monitored for a further 12 months until July 2009, at which stage eight participants were still on treatment on the YPP.

At 3, 6, and 12 months after treatment commencement, 63, 55, and 50 patients were in treatment on the YPP, respectively (see Table 2). Of the 50 patients who were in treatment after 1 year, urinalysis was available on 49 during their 12th month of treatment. Of these, 19 demonstrated complete abstinence from heroin use during that month (see Table 1).

Ninety-two patients had progressed out of treatment from the YPP at the end of the study period. Of these, the overall proportion exiting via planned discharge following detox was 22%. The proportions finally exiting via dropout and via imprisonment were 32% and 8%, respectively. The proportion that was ultimately transferred to another setting for ongoing opiate substitution treatment was 39%. There was just 1 disciplinary discharge. Treatment duration and the final progression route are reported in Table 1, by gender. Males were more likely than females to be imprisoned. Of the 36 transferred elsewhere for ongoing treatment, 7 had previously completed a detox but had relapsed.

The median time gap from first entry into treatment to final discharge from the YPP for those who exited following detox completion was 4 months (range = 10 days to 42 months, interquartile range [IQR] = 7 weeks to 19 months). It was 7 months (range = 6 days to 30 months, IQR = 2–13 months) for those who dropped out of treatment and 23 months (range = 1 week to 44 months, IQR = 15–31 months) for those who transferred to another service for ongoing opiate substitution treatment.

3.4. Incidence of hepatitis C virus and HIV infection

Of the 84 people who agreed to undergo hepatitis C viral (HCV) serology, 17 (20%) were antibody-positive at baseline. Thirty-seven of those who initially tested negative were later retested, and 6 seroconverted during 53.4 years of

follow-up, giving an incidence of 11 infections per 100 PYAR (95% CI = 4–22 per 100 PYAR). Of the 46 who reported a history of injecting, 36 were screened for HCV, and 12 (33%) were seropositive at baseline. The incidence of HCV among the 19 injectors retested was 3 infections in 21.5 person years or 14 per 100 PYAR (95% CI = 3–35 per 100 PYAR). All of the 69 patients tested for HIV at baseline were negative. Of these, 31 underwent at least one further test on the YPP during 42.3 years of follow-up, and all remained seronegative.

3.5. Mortality

There were no deaths during treatment among these 100 patients who had a cumulative period of 129 PYAR. Fifty patients left treatment within 12 months of starting on the YPP. Of these, we were able to confirm that 47 were alive at 12 months, but there was no information on the status of the other 3 patients.

4. Discussion

4.1. Patient characteristics

The patient population showed evidence of quite profound psychosocial adversity at baseline in common with similar patient groups across the world (Crome et al., 2000; Millman et al., 1978). The slight excess of females in this age range contrasts with adult populations of heroin users where males account for about 70% of treatment contacts in Ireland (Carew et al., 2009). In Australia, Bell and Mutch (2006) also found that females outnumbered males in their cohort. In the United States, the gender profile among adolescent heroin users accessing treatment was almost equal (SAMHSA, 2009).

4.2. Opiate detoxification

Most teenage heroin users themselves, and nearly all referrers and parents, aspire to a goal of abstinence (Crome et al., 2000). Despite holding an ambition that the patients attending the YPP would ultimately detox, only 22% left the treatment service via this route. Many others who completed a detox relapsed quite quickly and reaccessed opiate substitution treatment again. Although abstinence proved somewhat elusive for our young patients, it should be borne in mind that a pattern of relapse and multiple treatment episodes is commonplace across all severe addictions in this age range (Fishman, 2011). Adult heroin users also struggle to attain this goal. In a recent study of treatment outcome among more than 18,000 adult heroin users in England, Marsden et al. (2009) found that just 5% had a planned discharge from medication-assisted treatment within their first year of treatment. In Ireland, it is estimated that just 1% of adults on methadone treatment exit via a planned detox each year (Comptroller & Auditor General, 2009).

The proportion progressing from treatment via planned detox is less than the 29% as reported by Millman et al. (1978). Those who detoxed had spent a mean period of 28 months on methadone in their study in New York. Their service therefore worked with patients for even longer periods than occurred on the YPP. They appear to have had a much less dispersed catchment area than that which exists on the YPP, perhaps permitting them to provide more active and ongoing support to those who completed detox.

4.3. Treatment dropout and imprisonment

In common with others, we found that dropout from treatment was commonplace, especially during the first 3 months of treatment (Bell & Mutch, 2006; Kellogg et al., 2006; Millman et al., 1978; Marsch et al., 2005). A third of the early dropouts did subsequently reenter treatment in our population. Because of the more generous staffing of the YPP, it can provide higher levels of program structure, patient support, and monitoring than the typical community-based adult addiction treatment services in Dublin. Although most patients welcome this and it may assist patient retention and reengagement, it is possible that others prefer the less demanding treatment approaches used in other adult orientated services, and many YPP dropouts may have subsequently reaccessed treatment in those settings, especially following their 18th birthday.

Despite the frequent history of extensive criminality at baseline, less than 10% were imprisoned while in treatment. We view this as a qualified success for the service. Males were more likely to have a history of incarceration prior to treatment entry and were more likely to exit treatment via imprisonment. There were no other gender differences in outcomes.

4.4. Ongoing opiate substitution treatment

We found that the most common progression route was transfer to the adult addiction service for ongoing treatment. Although this ensures that patients continue to benefit from the harm-reducing benefits of opiate substitution treatment, it does come as a disappointment to many teenagers and to their relatives. Again, it reflects international experience and the reality that many young patients require a longer period of treatment than that offered on the YPP (Bell & Mutch, 2006; Millman et al., 1978). Many patients arrived into the YPP with evidence of major coexisting difficulties including poor education attainment, family histories of opiate and alcohol abuse, and significant comorbid mental health difficulties. In light of these problems, the challenge of attaining and sustaining complete opiate abstinence is very substantial. Woody et al. (2008) reported that most opioid-dependent youth quickly returned to drug use following detox completion and argued that prolonged opiate substitution treatment will be necessary for many young patients. Continuity of treatment is a key predictor of patient outcome, and our successful efforts to actively facilitate transfer into ongoing treatment are therefore important (Fishman, 2011; NICE, 2007).

4.5. Impact on heroin use

Urinalysis indicated that more than one third of our patients on treatment at 12 months were completely abstinent from heroin, and there was evidence of reductions in heroin use in a further half of patients. This suggests that this treatment may indeed be effective in reducing heroin use in this young age range. Although there have been a small number of recent rigorous examinations of heroin use after 1 to 3 months on opiate substitution treatment in youth, there has been a paucity of literature looking at longer term outcome (Minozzi et al., 2009). We share the view that many heroin-dependent adolescents require treatments of at least 1-year duration, and more long-term outcome studies are needed (Hopfer et al., 2002).

4.6. Blood-borne viral infection outcomes

It is well established that MMT results in reductions in unsafe injecting in adults (Marsch, 1998). We found that the incidence of HCV was just 14 per 100 PYAR among our very young subgroup of injecting drug users (IDUs). Younger age is a recognized risk factor for increased HCV incidence among IDUs (van Beek, Dwyer, Dore, Luo, & Kaldor, 1998). Although our sample size is very small, our finding compares favorably with an earlier Dublin study that reported an HCV incidence among IDUs of 66 infections per 100 PYAR in the 1990s (Smyth, O'Connor, Barry, & Keenan, 2003).

4.7. No deaths observed

Although there have been some small-scale studies of opiate substitution treatment in adolescents, its safety is not well established (Minozzi et al., 2009; O'Brien, 2005). There were no deaths among those in treatment at the YPP during this study. It is during the months following treatment exit, whether by planned detoxification or dropout, that mortality is seen to rise in adult populations (Fugelstad, Stenbacka, Leifman, Nylander, & Thiblin, 2006). Among those who left treatment within 12 months of starting on the YPP, we were able to confirm that they were alive on their 1-year anniversary of treatment commencement in 94% of cases. Our study was not powered to draw any firm conclusions on the safety of this treatment in adolescents or its impact on mortality, but we did not detect any evidence that it is particularly hazardous.

4.8. Limitations

The limitations of the study include its naturalistic design and limited information on those patients who were not in treatment at each of the time points examined. Use of a validated assessment instrument such as the Maudsley Addiction Profile would have assisted in permitting easier international comparison (Marsden et al., 1998). Although our findings indicate the dynamic nature of treatment departure and reentry, the method of data collection will have underestimated this phenomenon. For example, if a patient dropped out of treatment or detoxed during Month 8 and subsequently returned in Month 10, then this will not have been captured as we ascertained location on Month 6 and Month 12, at which points such a patient would have been in treatment. Although we have provided urinalysis data for those who were still in treatment at 12 months, we did not obtain any outcome information of opiate use among those who departed treatment in a planned or unplanned manner prior to this point. Our finding that 22% of patients exited treatment following detox completion cannot be interpreted as indicating that this proportion attained long-term abstinence as outcome after discharge was not measured. National and international experience indicates that many will have relapsed within months of discharge from the YPP (NICE, 2007).

The study only examined outcome of those who persisted with the relatively long assessment process and succeeded in commencing medication treatment. The clinical decision to require three assessment appointments was made on the basis of a desire to avoid a situation whereby nondependent patients might inappropriately commence treatment. Most patients negotiated this hurdle, with just 12 heroin-dependent patients dropping out of the assessment process. Nevertheless, a faster journey into treatment may have resulted in more study participants and may have altered the detected outcome profile.

The treatment provided to patients was heterogeneous and tailored to their individualized care plan. Although this is the nature of most clinical practice, it does nevertheless complicate interpretation of our outcome findings. We have provided substantial information on the approach to treatment to assist the reader in determining how applicable our findings may be to other treatment settings. The methadone doses, averaging 50 mg, may be seen to be insufficient. However, this relatively low average dose reflects the fact that many patients were undergoing detoxification at each time point, and doses of up to 90 mg were prescribed where indicated.

Although information from the CTL indicates that our patient group is representative of treated opiate adolescents in Dublin, it is a relatively small study sample and contrasts starkly with the large sample sizes included in some studies of treatment outcome in adult populations of heroin users (Marsden et al., 2009). Although this is the nature of research studies on adolescents, it does nevertheless hamper interpretation of our findings, especially those relating to events that are quite rare, such as deaths, HIV, and hepatitis C seroconversion. Although clinical trials represent the gold standard for outcome research, there are enormous practical difficulties conducting such trials within this adolescent patient group to examine interventions of appropriately long-term duration (Minozzi et al., 2009; Woody et al., 2008). Even in a country as vast as the United States, only 50 adolescent heroin users were due to commence methadone or buprenorphine in 2007 (SAMHSA, 2009).

4.9. Implications for service delivery

Heroin dependence represents a complex and serious clinical problem and poses major treatment challenges. Although many adolescent patients enter opiate substitution treatment with an aspiration to detox and leave treatment, our findings, and those of others, indicate that this goal is rarely attained. Services must be prepared for a significant challenge in engaging and retaining this patient group in treatment, as about one third will drop out at least once, especially early in treatment. In common with adult patient groups, most of those who remain in treatment demonstrate reductions in heroin use. In view of the relatively large proportion of patients who never complete a detox and the relapses that occur among those who do, patients, parents, and referrers should be aware that opiate substitution treatment will be ongoing beyond 1 year for close to half of all of these very young patients.

References

- Bell, J., & Mutch, C. (2006). Treatment retention in adolescent patients treated with methadone or buprenorphine for opioid dependence: A file review. *Drug and Alcohol Review, 25*, 167–171.
- Bulter, S. (2002). The making of the methadone protocol: The Irish system? *Drugs: Education, Prevention and Policy, 9*, 311–324.

- Carew, A. M., Bellerose, D., Lyons, S., & Long, J. (2009). Trends in treated problem opiate use in Ireland, 2002 to 2007. Dublin: Health Research Board.
- Center for Substance Abuse Treatment. (2005). Initial screening, admission procedures, and assessment techniques. In S. L. Batki, J. F. Kauffman, I. Marion, M. W. Parrino, & G. E. Woody (Eds.), *Medication-assisted treatment for opioid addiction in opioid treatment programs* (pp. 43–61). Rockville (MD): Substance Abuse and Mental Health Services Administration Treatment improvement protocol (TIP) Series. DHHS Publication No. (SMA) 05-4048.
- College of Physicians & Surgeons of Ontario. (2005). Methadone maintenance guidelines. Toronto, Ontario: College of Physicians & Surgeons of Ontario.
- Comptroller and Auditor General. (2009). Drug addiction treatment and rehabilitation. Dublin: Department of Community, Rural and Gaeltacht Affairs. http://www.audgen.gov.ie/documents/vfmreports/64_Drug_Addiction_and_Rehab.pdf. (accessed 7 December 2010).
- Crome, I. B., Christian, J., & Green, C. (2000). The development of a unique designated community drug service for adolescents: Policy prevention education implication. *Drugs: Education, Prevention and Policy*, 7, 87–108.
- Department of Health. (2009). Guidance for the pharmacological management of substance misuse among young people. London: Department of Health. http://www.dh.gov.uk/prod.consum_dh/groups/dh_digital_assets/documents/digitalasset/dh_106429.pdf. (accessed October 12, 2009).
- Dept of Health & Children. (2005). *Report of the Working Group on treatment of under 18s presenting to treatment services with serious drug problems*. Dublin: Dept of Health & Children, Dublin.
- Fishman, M. (2011). Placement criteria and treatment planning for adolescents with substance use disorders. In Y. Kaminer, & K. C Winters (Eds.), *Clinical manual of adolescent substance abuse treatment*. Washington, DC: American Psychiatric Publishing.
- Fudala, P. J., & Woody, G. W. (2004). Recent advances in the treatment of opiate addiction. *Current Psychiatry Reports*, 6, 339–346.
- Fugelstad, A., Stenbacka, M., Leifman, A., Nylander, M., & Thiblin, I. (2006). Methadone maintenance treatment: The balance between life-saving treatment and fatal poisonings. *Addiction*, 102, 406–412.
- Gonzales, R., Brecht, M., Mooney, L., & Rawson, R. A. (2011). Prescription and over-the-counter drug treatment admissions to the California public treatment system. *Journal of Substance Abuse Treatment*, 40, 224–229.
- Hopfer, C. J., Khuri, E., Crowley, T. J., & Hooks, S. (2002). Adolescent heroin use: A review of the descriptive and treatment literature. *Journal of Substance Abuse Treatment*, 23, 231–237.
- Kaminer, Y., & Marsch, L. A. (2011). Pharmacotherapy of adolescent substance use disorders. In Y. Kaminer, & K. C Winters (Eds.), *Clinical manual of adolescent substance abuse treatment*. Washington, DC: American Psychiatric Publishing.
- Kellogg, S., Melia, D., Khuri, E., Lin, A., Ho, A., & Kreek, M. J. (2006). Adolescent and young adult heroin patients: Drug use and success in methadone maintenance treatment. *Journal of Addictive Disease*, 25, 15–25.
- Lehmann, W. X. (1973). The use of 1-alpha-acetyl-methadol (LAAM) as compared to methadone in the maintenance and detoxification of young heroin addicts. *NIDA Monograph*, 8, 82–83.
- Marsch, L. (1998). The efficacy of methadone maintenance interventions in reducing illicit opiate use, HIV risk behavior and criminality: A meta-analysis. *Addiction*, 93, 515–532.
- Marsch, L. A., Bickel, W. K., Badger, G. J., Stohart, M. E., Quesnel, K. J., Stanger, C., & Brooklyn, J. (2005). Comparison of pharmacological treatments for opioid-dependent adolescents: A randomized controlled trial. *Archives of General Psychiatry*, 62, 1157–1164.
- Marsden, J., Gossop, M., Stewart, D., Best, D., Farrell, M., Lehmann, P., et al. (1998). The Maudsley Addiction Profile (MAP): A brief instrument for assessing treatment outcome. *Addiction*, 93, 1857–1868.
- Marsden, J., Eastwood, B., Bradbury, C., Dale-Perera, A., Farrell, M., Hammond, P., et al. (2009). Effectiveness of community treatments for heroin and crack cocaine addiction in England: A prospective, in-treatment cohort study. *Lancet*, 374, 1262–1270.
- McKay, J. R. (2009). Continuing care research: What we have learned and where we are going. *Journal of Substance Abuse Treatment*, 36, 131–145.
- Millman, R. B., Khuri, E. T., & Nyswander, M. E. (1978). Therapeutic detoxification of adolescent heroin addicts. *Annals of the New York Academy of Science*, 311, 153–164.
- Minozzi, S., Amato, L., & Davoli, M. (2009). Maintenance treatments for opiate dependent adolescent. *Cochrane Database of Systematic Reviews*, doi: 10.1002/14651858.CD007210.pub2. Issue 2. Art. No.: CD007210.
- Motamed, M., Marsch, L. A., Solikhah, R., Bickel, W. K., & Badger, G. J. (2008). Differences in treatment outcomes between prescription opioid-dependent and heroin-dependent adolescents. *Journal of Addiction Medicine*, 2, 158–164.
- NICE. (2007). Methadone and buprenorphine for the management of opioid dependence. London.
- NTA. (2009). Getting to grips with substance misuse among young people. London: National Treatment Agency for Substance Misuse. http://www.nta.nhs.uk/uploads/nta_young_peoples_report_2009.pdf. (accessed 24 June 2010).
- O'Brien, C. P. (2005). Adolescent opioid abuse. *Archives of General Psychiatry*, 62, 1165.
- SAMHSA. (2009). The TEDS Report: Characteristics of adolescent heroin admissions. Rockville, MD.
- Sells, S. B., & Simpson, D. D. (1979). Evaluation of treatment outcome for youths in the Drug Abuse Reporting Program (DARP): A follow-up study. In G. M. Beschner, & A. A. Friedman (Eds.), *Youth drug abuse: Problems, issues and treatment* (pp. 571–622). Lanham, MD: Lexington Books.
- Smyth, B., & O'Brien, M. (2004). Children attending addiction treatment services in Dublin, 1990–1999. *European Addiction Research*, 10, 68–74.
- Smyth, B. P., O'Connor, J. J., Barry, J., & Keenan, E. (2003). Retrospective cohort study examining incidence of HIV and hepatitis C infection among injecting drug users in Dublin. *Journal of Epidemiology & Community Health*, 57, 310–311.
- Woody, G. E., Poole, S. A., Subramaniam, G., Dugosh, K., Bogenschutz, M., Abbott, P., et al. (2008). Extended vs short-term buprenorphine-naloxone for treatment of opioid-addicted youth: A randomized trial. *Journal of the American Medical Association*, 300, 2003–2011.
- van Beek, I., Dwyer, R., Dore, G. J., Luo, K., & Kaldor, J. M. (1998). Infection with HIV and hepatitis C virus among injecting drug users in a prevention setting: Retrospective cohort study. *British Medical Journal*, 317, 433–437.