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An investigation of an open-access model for scaling up methadone maintenance treatment

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ABSTRACT

Aims To examine retrospectively patient and programmatic outcomes following the development and implementation of an 'open-access' model in which prospective patients were enrolled rapidly in methadone maintenance treatment, irrespective of ability to pay, and provided real-time access to multiple voluntary treatment options. **Design** Medical and administrative records were abstracted to compare data for 1 year before and 9 years after initiating the implementation of an open-access treatment model in May 2007. **Setting** Methadone maintenance treatment center in Connecticut, USA. **Participants** Individuals with opioid use disorder entering treatment between July 2006 and June 2015. In June 2015, 64% (n = 2594) of the sample were men and 80% (n = 3133) reported that they were white. **Intervention** The Network for the Improvement of Addiction Treatment-informed open-access treatment model uses process improvement strategies to improve treatment access and capacity. **Measurements** Census, waiting time, retention, non-medical opioid use, patient mortality and financial sustainability (net income and state-block grants as proportions of revenue). **Findings** In the 9 years following the initial implementation of the open-access model, patient census increased by 183% from 1431 to 4051, and average waiting-time days decreased from 21 to 0.3 (same day) without apparent deleterious effects on rates of retention, non-medical opioid use or mortality. Between fiscal years (FY) 06 and FY 15, net operating margin rose from 2 to 10%, while state-block grant revenues declined 14% and the proportion of total revenue from state-block grant revenue decreased from 49 to 24%. **Conclusions** An open-access model for rapid enrolment of people with opioid use disorder in methadone treatment appears to improve treatment access, capacity, and financial sustainability without evidence of deleterious effects on treatment outcomes.

Keywords Access to health care, capacity building, implementation science, methadone, opioid-related disorders, program sustainability.

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INTRODUCTION

The current opioid epidemic is a major public health issue [1,2] requiring urgent attention. Among the 29 000 000 people with substance use disorders globally, only 14% have accessed treatment [3]. From 2000 to 2013, the estimated number of individuals with opioid use disorder (OUD) in the United States has risen from approximately 600 000 to more than 2 million (586 000 heroin; 1 980 000 prescription[1]) [4,5]. However, it is estimated that of individuals with OUD, only 21% receive any past-year substance abuse treatment [6] and only 15–20% receive medication-assisted treatment (MAT) [7]. OUD is a chronic relapsing medical condition [8] and is associated with elevated risk of mortality, transmission of hepatitis C and HIV and a range of other serious biopsychosocial problems [9–11]. In 2015, an estimated 33 091 deaths in the United States involved an opioid [12]. Consequently, the costs to the United States of opioid-related disorders are considerable; estimated annual health-care, work-place and criminal justice costs exceed $55 billion [13].

[1]Numbers were not provided for the estimated overlap between heroin and prescription opioid groups.

Improved access to evidence-based MAT such as methadone (opioid agonist), buprenorphine (partial opioid agonist) or injectable naltrexone (opioid antagonist) is a crucial public health strategy in confronting the opioid epidemic [2,14–16]. The incorporation of psychosocial treatments is an internationally recommended strategy for managing opioid-related disorders [17,18]. Beyond effective treatment of OUD, MAT has several additional public health benefits by reducing transmission of hepatitis C and HIV, overdose, all-cause mortality and illegal activity; it also improves social functioning and health-care engagement [15,16,19–22]. Despite an increase in excess of 230% between 2003 and 2012 in the estimated number of people in the general population with OUD, the number of opioid treatment programs (OTPs)[2] operating in the United States increased by only 9.4% (from 1067 to 1167), while the number of patients receiving methadone maintenance treatment increased by only 37.3% (from 227 003 to 311 718) [23]. Although buprenorphine has increased treatment capacity significantly for OUD in the United States [24,25], the estimated gap in 2012 between MAT need (i.e. number of individuals with OUD) and capacity (i.e. number of opioid agonist MAT slots[3]) was approximately 1.3 million [23]. Recent governmental initiatives have allocated funding to expand access to MAT [26,27]; however, there is a paucity of evidence-based models that incorporate costs and which guide MAT implementation.

The Network for the Improvement of Addiction Treatment (NIATx) [28], which began as a partnership between the Robert Wood Johnson Foundation and the Center for Substance Abuse Treatment, was designed specifically to identify and overcome treatment access barriers (and thus build capacity). However, neither long-term outcomes nor financial sustainability has been examined for NIATx or other implementation frameworks. The aim of this study was to examine, during a 10-year period, the impact on patient census, admission waiting time, retention, non-medical opioid use and financial sustainability associated with developing and implementing the 'open-access' treatment model (where prospective patients are enrolled rapidly in methadone maintenance treatment, irrespective of their ability to pay, and provided with real-time access to manifold group and individual treatment options from which they are free to choose).

METHODS

Study site and sample

The APT Foundation, Inc. (hereafter referred to as APT) is a Connecticut-based not-for-profit community-based organization, founded in 1970, which specializes in the treatment of substance use disorders, and is affiliated with the Yale University School of Medicine. APT also provides primary care, psychiatric, counseling and vocational services. The sample comprises patients who entered outpatient methadone maintenance treatment at APT between July 2006 and June 2015. In June 2015, 64% (n = 2594) of the sample were men, and 80% (n = 3133) reported that they were white. Patients' mean [standard deviation (SD)] age was 42.4 (SD = 16.6) years. Licensed clinicians confirmed that patients met DSM-IV-TR criteria for OUD before they began methadone maintenance. While opioid agonist treatment with buprenorphine was available at APT from 2006, regulatory and financial barriers precluded offering it to all prospective patients. Additionally, admitting clinicians sometimes determined that maintenance on methadone was a better fit for prospective patients.

Overview of Network for the Improvement of Addiction Treatment (NIATx) procedures

NIATx uses a quality improvement procedure common in engineering and implementation science called 'rapid-cycle testing' [29], which involves defining the task or 'change project', performing a 'walk-through' in which change-team members navigate the same procedures that the prospective or existing patient follows when seeking or receiving services, identifying the change project aim, collecting baseline data and testing the changes [29]. Changes that move the organization towards improved access, treatment capacity or retention are viewed as successful, and are adopted by the organization. A more complete description of the NIATx organizational change model can be found elsewhere [28,30,31].

Development and implementation of the open-access model at APT

The development and implementation of the open-access model occurred in two phases. The first phase began in May 2007, when APT began using the NIATx rapid-cycle model. A change team was established comprising the chief executive officer (a NIATx-trained coach), medical director, clinical services director and human resources director. A walk-through of existing intake procedures identified multiple possible barriers involving waiting time and access (see Table 1). The change team initiated a series of change projects to improve waiting time and access: (1) tuberculosis testing procedures were

[2]Historically, these programs were often referred to as methadone maintenance treatment programs.

[3]Estimated number of slots was calculated by the authors using SAMHSA data on OTPs and physicians waived to administer, dispense or prescribe buprenorphine under the Drug Addiction Treatment Act.

Table 1 Summary of change projects in the development and implementation of the open-access model.

Phase[a]	*Identified barriers*	*Change projects to address barriers*
1	• Admission occurred only after results from PPD for tuberculosis were read	• PPD was placed (but not read) before admission since positive findings are not a contraindication for beginning methadone maintenance
1	• Patients required to provide documentation or contact information for an adult to verify addiction history	• Procedures for verification of addiction were altered so that they could be performed on the same day[b]
1	• Patients required to pay back balances and upfront fees to cover administrative costs, PE and tapering (in case of discontinuation of methadone maintenance)	• Discontinued back-balance payment requirement and upfront administrative, PE and tapering fees
1	• Patients admitted only if self-pay or with insurance coverage	• Eligible patients admitted irrespective of insurance coverage or ability to self-pay. Following admission, patients without insurance were assisted in procuring it (e.g. Medicaid)
2	Long waiting time • Admission process divided into screening, intake, PE and methadone initiation—all conducted on different days by appointment • Full PE needed prior to admission	• Regularly scheduled walk-in screening, intake, medical screening and methadone initiation available same day, Monday–Friday[c] • Medical screening for contraindications conducted prior to admission; PE performed on walk-in basis after admission
2	Counseling • Patients were assigned a counselor whom they met with one-on-one by appointment and were sometimes assigned to a scheduled treatment group led by the counselor	• Primary mode of counseling changed to 'drop-in' groups[d]; individual counseling available on request or as-needed
2	Methadone dosing • Non-standardized dosing protocol • Sub-therapeutic maintenance dosing	• Standardized dosing protocol implemented • Therapeutic maintenance target dose (i.e. ≥ 90 mg daily) within 30 days of admission
2	Take-home methadone bottles[e] • Eligible patients not receiving take-home bottles • Reliance on patient request	• Routine review of patients' take-home bottle eligibility performed by clinical teams • Eligible patients were contacted to review criteria and complete relevant paperwork
2	Administrative discharge criteria • Inability to pay for services • Ongoing substance use • Behaviors deemed 'inappropriate' by providers such as arguments or non-attendance • No standardized protocol	• Inability to pay no longer a criterion for discharge • Ongoing substance use (unless unsafe) no longer a discharge criterion • Inappropriate behaviors (unless a risk to patient or staff safety) no longer a discharge criterion • Patients discharged only after review by clinical team and approval of chief executive officer confirming safety risk or absence of treatment efficacy

[a]Phase 1 barriers to waiting time and access were identified following an initial walk-through of extant intake procedures. Phase 2 barriers to access, retention and capacity were identified by change team members. [b]Consistent with federal requirements, all admitted patients met with a clinician who formally evaluated the patient for opioid use disorder; eligibility for admission was confirmed by a licensed medical provider. [c]During walk-in visits, patients can meet with a provider without an advance appointment. [d]Patients were offered Monday–Friday access to a variety of 50-minute groups (starting every 30 minutes from approximately 5 a.m. to 3 p.m.). Patients choose whether to return for another session after attending a particular group or to try a different group on subsequent visits with a minimal expectation of attending at least one group per month. [e]In accordance with federal and state regulations, methadone maintenance programs can provide patients who demonstrate abstinence from illicit drugs and stability (e.g. regular attendance) with take-home methadone. Without take-home bottles, patients need to attend their programs daily for methadone (the elimination half-life of methadone is 8–59 hours), and this comprises a burden to both patients and medicating staff and poses a possible barrier to retention and treatment capacity. PPD = purified protein derivative; PE = physical examination.

modified;[4] (2) procedures for verification of addiction were altered; (3) requirement to pay back balances and upfront administrative, physical examination and tapering fees were discontinued; and (4) admission fee structure was altered. The second phase began in fall 2007. Change teams [whose composition varied, but typically included the chief executive officer (CEO) and a clinic director] identified barriers to access, retention and expanding treatment capacity. The development and implementation of key elements of the open-access model occurred during this phase, including walk-in evaluations, same-day treatment initiation and provision of 'drop-in' groups. Some change projects addressed factors identified previously as barriers to methadone maintenance access or retention, including long waiting time [32], financial costs to patients [33,34] and subtherapeutic methadone dosing [35,36]. Other

[4]In the United States, tuberculosis screening/testing and a physical examination are federal requirements for patients entering methadone maintenance treatment.

barriers were suggested by change team members, including appointment-making for individual counseling, take-home medication procedures and administrative discharge criteria. As summarized in Table 1, a series of change projects was implemented to target these barriers.

Outcomes and measures

Study data were collected as part of routine quality assessment and improvement procedures and were abstracted from administrative and patient medical records. Primary outcomes were census (number of patients enrolled in treatment), waiting time (number of days between first face-to-face appointment and first methadone dose), retention (the proportion of patients who were in treatment 90 days after starting a treatment episode), illicit opioid use (as evidenced by a positive urine specimen), patient mortality (number of deaths each year for both active patients and those discharged within the previous 30 days) and financial sustainability (net income and state-block grants as proportions of total revenue). Consistent with federal requirements for OTPs, urine samples were collected on patients at least eight times per year; not all patients were tested in any given month. Urine samples were analyzed by offsite commercial laboratories using a 300 ng/ml cut-off for illicit opioids. Study procedures were approved by the APT Board of Directors and the Institutional Review Board of Yale School of Medicine.

Data analysis

We tabulated descriptive statistics for study outcomes (frequencies or means and standard deviations for continuous data and percentages for categorical data). We compared outcomes for approximately 1 year before and 9 years after initiating the implementation of the open-access model in May 2007. The samples used in calculating descriptive statistics each year were not independent, but represented a cumulative, changing cohort of patients admitted, retained or discharged over a 10-year period. Consequently, we did not use inferential statistics to analyze change in outcomes over time associated with the evolving implementation of the open-access model. Instead, we examined outcome data at specific time-intervals [usually the end of each fiscal year (FY)], a data-analytical procedure used by NIATx researchers [37]. Retention was calculated by measuring the number of people who were admitted in the third quarter of each FY (January–March) who were retained in care 90 days later. Non-medical opioid use was estimated by calculating the proportion of opioid-positive samples from the urinalysis tests conducted in June each year. Financial sustainability was evaluated with data from the 12 months of each FY from 2006 to 2015 to calculate percentages of annual revenue comprising state-block grant revenue and net income. Patient mortality data began to be collected systematically in FY 2008.

RESULTS

Census, waiting time and retention

As summarized in Fig. 1, following the implementation of the open-access model, patient census increased. Between July 2006 and July 2015, patient census increased 183% from 1431 to 4051, while between June 2006 and June 2015 the mean days of waiting time decreased from 21.3 to 0.3 (same day). Whereas in 2007, the mean waiting time was 7.8 days, beginning in 2008, it was reduced to 2 days or less. Since 2013 it has been less than 1 day, representing same-day treatment access.

Retention data for patients who enrolled in methadone maintenance at APT between 1 July 2007 and 30 June 2015 are summarized in Fig. 2. In the year prior to the implementation of the open-access model, the mean rate of 90-day retention was 89.3%; in the subsequent 9 years, mean retention ranged from 81.9 to 91.8%.

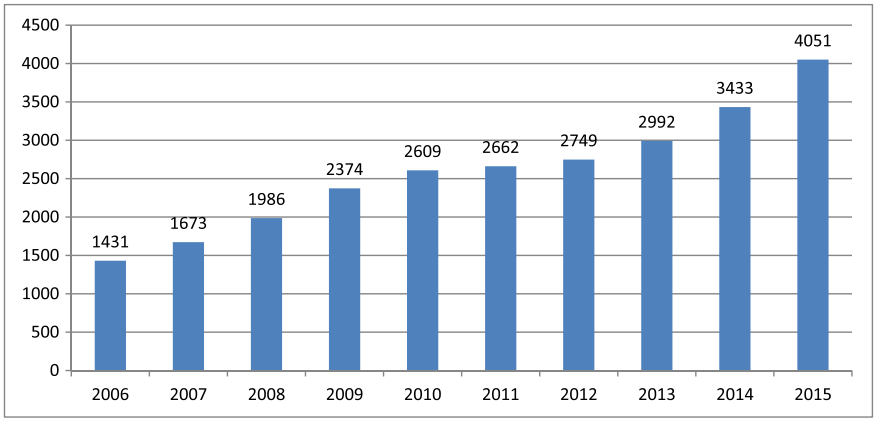

Figure 1 Patient census 2006–15. Census data were collected on 1 July each year and comprise non-duplicate patients. [Colour figure can be viewed at wileyonlinelibrary.com]

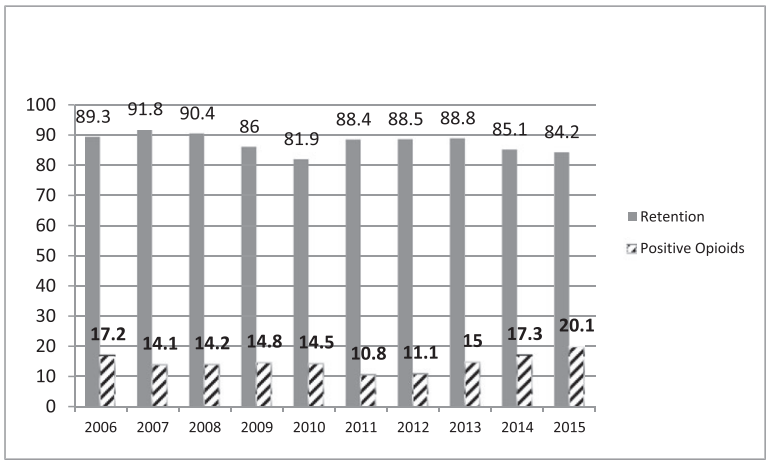

Figure 2 Percentage of patients retained in treatment 90 days after admission and percentage of urine samples testing positive for illicit opioids. Retention data pertain to the fourth quarter of each fiscal year (i.e. the percentage of patients enrolled on 30 March who were retained throughout the following 90 days). Urine sample findings pertain to specimens collected in the month of June each year

Non-medical opioid use

Figure 2 also summarizes findings regarding the proportions of urines collected throughout the month of June for 10 consecutive years that tested positive for opioids other than methadone (i.e. for the June prior to the implementation of the open-access model and subsequent 9 years). In June 2006, 17.2% of urine samples tested positive for opioids. Subsequently, each June, the proportion of urine samples testing positive for opioids ranged from 10.8 to 20.1%.

Patient mortality

Annual patient mortality data are summarized in Table 2. Between FY 2008 and 2015, the number of annual patient deaths ranged from 13 to 30, for a mortality rate range of 0.0047–0.0101%. Ten deaths during this time-period were found to result from overdose.

Financial sustainability

Figure 3 summarizes the proportions of total annual revenue comprising state-block grant revenue and net income for the year preceding the implementation of the open-access model and for the ensuing 9 years. Between FY 2006 and FY 2015 there was a 14% decline in the total amount of state-block grant dollars; in other words, grant revenues as a proportion of total annual revenue decreased from 49 to 24%. During the same time-period, net operating margin rose from 2 to 10% and there was an increase in the proportion of total annual revenue comprising net income. Increased net income resulted from greater patient volume, enhanced operating efficiency (e.g. streamlining intake procedures) and expansion of coverage for methadone maintenance as a function of the Affordable Care Act.[5]

DISCUSSION

This is one of the first studies to examine the implementation of a NIATX-informed addiction treatment delivery model over multiple years. Following the introduction of the open-access model, there were considerable decreases in admission waiting time and increases in treatment access and capacity without apparent deleterious effects on retention, non-medical opioid use or financial stability. Findings here provide a framework for scaling up MAT both in the United States and internationally, where the need for treatment of OUD in response to the opioid epidemic is needed urgently.

Census and waiting time

Relative to national statistics from 2003 to 2012, when patient census (or treatment capacity) increased only 37% [23], our census increased by 183% over 10 years (from 1431 to 4051) following implementation of the open-access model. During the first 5 years of the open-access model most patients were screened, assessed and medicated on the same day. Reduced waiting time was achieved partly by shortening delays between initial screening, intake and admission (e.g. instituting walk-in same-day intake/admission). OTPs have operated traditionally (and in the case of non-profits have been financed) under the assumption that a fixed number of individuals could be treated at any given time: when demand for treatment exceeds allocated treatment slots, prospective patients are turned away or assigned to a waiting list [32], and consequently many do not enter treatment [34,38]. There is considerable variability throughout countries in the availability and accessibility (including waiting times) of MAT with some countries, such as France, having achieved

[5]Although the data are not presented, a visual analysis of the findings indicated that there were no observabledifferences on outcomes between the sites, all of which are located in New Haven County, CT.

Table 2 Patient mortality in fiscal years (FY) 2008–2015.

FY	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*
#Deaths	15	13	17	27	13	28	30	30
Overdose deaths	1	6	2	1	0	0	0	0
Patient census	1986	2374	2609	2662	2749	2992	3433	4051
Mortality rate	0.0076	0.0055	0.0065	0.0101	0.0047	0.0094	0.0087	0.0074

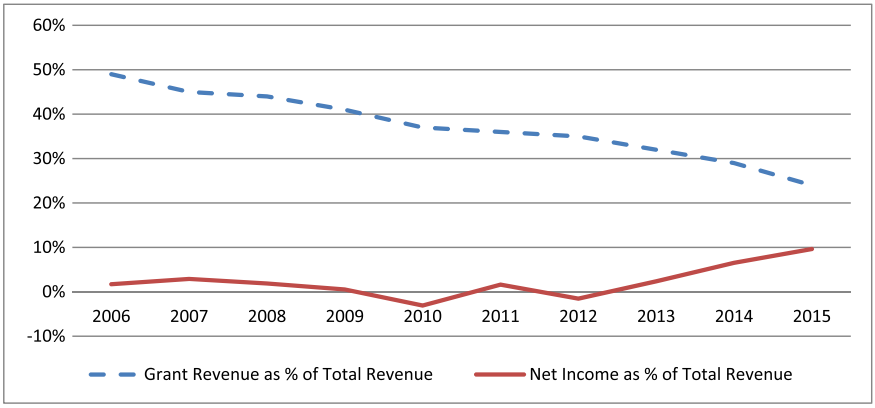

Figure 3 Percentages of annual total revenue comprising state-block grants and net income in fiscal years 2006–15. [Colour figure can be viewed at wileyonlinelibrary.com]

great country-wide success in expanding availability and improving access [39,40]. Waiting times of at least 1 month for methadone maintenance are common in the United States [41]. Individuals referred from the criminal justice system or with co-occurring psychopathology, or those of racial/ethnic minority status or with lower educational levels, are at increased risk of not enrolling in methadone maintenance when faced with long intake waiting times [32]. The open-access model offers a potentially important approach for eliminating extant treatment access disparities.

The Code of Federal Regulations (45 CFR 96.126) stipulates a 14-day limit on waiting time for individuals at high risk (e.g. people with HIV) or the provision of interim methadone treatment (IMT) involving daily on-site visits for methadone without take-home doses, counseling or services for a maximum of 120 days. While IMT has been advanced as an approach to minimize waiting times and enhance treatment access [42,43], the open-access model provides methadone maintenance services immediately, including medication, counseling and psychiatric treatment, and it does not impose a maximum treatment duration after which discharge or transfer occurs.

The change team identified long-standing barriers to treatment access (e.g. payment of back balances or upfront fees) that were not taking into account the characteristics of many patients who seek MAT (e.g. limited income). One important change project was altering the primary mode of counseling delivery from scheduled individual appointments to 'drop-in' groups and individual counseling, which enabled expanded capacity. While findings regarding the relative efficacy of adding counseling to pharmacotherapy with buprenorphine or methadone are mixed [44,45], the availability of drop-in psychosocial interventions has permitted the same number of counselors to treat more patients, and it has offered patients more access and choice about counseling.

Retention, non-medical opioid use and mortality

Because relapses are common among those who discontinue treatment [8,9], addressing the current opioid epidemic necessitates enhancing MAT access and capacity nation-wide without diminishing retention. The open-access model identified and addressed barriers to access (e.g. waiting time), retention (e.g. discharge criteria) and capacity (e.g. treatment delivery costs). The study extends findings from previous research on same-day treatment access by demonstrating that even as capacity escalated over multiple years, no noticeable loss in retention occurred [46–48]. The annual retention rates following the implementation of the open-access model were noticeably higher than those reported in randomized clinical trials [35,49]. While some programs discharge patients for continued illicit substance use, the open-access model eliminated this criterion without an apparent deleterious effect (as measured by urinalysis findings). While the percentage

of samples testing positive for opioids varied considerably, visual analysis of the data suggests no obvious associations between opioid-positive urines, treatment capacity and other study outcomes. Patients in MAT (even those who use illicit opioids periodically) have been found to be at significantly lower risk of overdose and mortality than their out-of-treatment peers [21,22]. Furthermore, even as treatment capacity escalated, mortality rates continued to be lower than in out-of-treatment individuals [9,50] and did not vary substantially from those in the general adult population [51]. Similar to findings of MAT expansion internationally [52], increased MAT access and capacity did not occur at the expense of safety [39].

Financial sustainability

Methadone maintenance is economically advantageous to society; it is associated with significantly lower utilization of emergency department and in-patient care as well as lower criminal justice-related costs [53,54]. One barrier to MAT scale-up internationally is the financial cost to patients and financial remuneration to OTPs. While patient-incurred cost is an important negative predictor of treatment access and retention [33,34], it is important to recognize that OTPs operate within intricate, patchwork and fluid reimbursement structures involving federal and state (e.g. Medicaid) as well as local programs (e.g. criminal justice); private insurance companies; and out-of-pocket patient payments [55]. Thus, scaling up methadone maintenance nation-wide requires a robust, practicable and cost-efficient implementation model. Consistent with prior NIATx-related research, implementation of the open-access model was associated with improved financial sustainability, as evidenced by respective increases and decreases in the proportions of total revenues attributable to net income and grants, respectively [56]. APT leveraged two important changes in health-care remuneration resulting from the Affordable Care Act: Medicaid coverage of substance use disorder treatment was expanded and commercial insurance carriers in Connecticut began covering methadone maintenance. Improved operating margins allowed APT to augment staffing to meet the demands of increased patient census and to offset state-block grant decreases while still offering services to patients, irrespective of their ability to cover the cost of services. APT was also able to gradually purchase and renovate its own space, rather than renting properties. The new spaces have greatly improved patient-centered physical facilities, further encouraging retention while reducing operating costs.

Limitations

Study limitations should be noted. Data were collected as part of routine quality improvement and assessment procedures, used commonly in implementation science, rather than from a rigorous research design. Thus, it was not possible to conduct subanalyses to analyze the effect of specific changes made by the organization (e.g. eliminating back balances) and outcomes of interest (e.g. mortality rates). We focused on opioid-positive—and not opioid-negative—urine samples because the former needs to be addressed by clinical staff. Although clinical trials often impute data from missing urine samples to be opioid-positive, we did not do this as the data were collected for quality improvement purposes. Nonetheless, it should be noted that there was a low rate of missing samples. Data regarding patient mortality were only available for FYs 2008–15; thus, it was not possible to compare mortality data before and after the implementation of the open-access model. Similar to other NIATX-related studies, change projects were implemented over relatively brief time-periods and outcomes were collected at similar time-points during the course of the study. Given the violation of statistical assumptions regarding independence of observations, we were unable to conduct advanced statistical modeling to analyze changes in important study outcomes following the implementation of the open-access model. NIATx data collection procedures, however, allow administrators to test multiple change projects at low cost and to collect pertinent on-site outcome data in real-time to inform organizational change [28,29]. Similar to any study of administrative or patient records, there may have been data entry errors and omissions [57]. This study was conducted in the OTPs operated by one non-profit community-based organization in the Northeast United States; the extent to which the findings generalize to other types of treatment programs (e.g. for-profit) or geographic locations is unknown. Lastly, reasons for non-retention at 90 days could not be determined because patients were not assessed individually or followed-up.

Conclusion

In the absence of efficient, effective and safe strategies such as this open-access treatment model, the global opioid epidemic will continue to extract high costs to individual and to public health. To our knowledge, this study is among the first to provide a framework with real-world outcomes over nearly a decade of implementation of the open-access model for scaling up MAT through incremental changes to admissions and continuing care. Public health efforts targeting the opioid epidemic have focused primarily on preventing or reducing non-medical use of prescription opioids. Although this is a critically important strategy, OUD is an often-overlooked driver of opioid overdose [15] and opioid-related mortality and morbidity [14]. Despite the recent decreases in the prevalence of non-medical use of prescription opioids among adults, the rates of OUD and

opioid-related mortality continue to increase [58]. MAT can treat OUD and reduce overdose effectively, yet as few as 15–20% of those who need it are treated with MAT [7]. Scaling up access to affordable MAT and building MAT capacity are essential to stem the tide of the current opioid epidemic, and will probably require flexibility on the part of existing programs to make changes to treatment delivery models and advocacy to ensure that government entitlements and commercial insurance carriers cover the costs of treatment [59]. The open-access model offers one promising public health approach for building MAT capacity, and deserves additional research investigation.

Declaration of interests

None.

References

1. Califf R. M., Woodcock J., Ostroff S. A proactive response to prescription opioid abuse. *N Engl J Med* 2016; **374**: 1480–5.
2. Murthy V. H. Ending the opioid epidemic—a call to action. *N Engl J Med* 2016; **375**: 2413–5.
3. United Nations Office on Drugs and Crime. World Drug Report 2016. United Nations Publication, sales no. E.16.XI.7. Available at: http://www.unodc.org/doc/wdr2016/WORLD_DRUG_REPORT_2016_web.pdf (accessed 16 October 2017) (Archived at http://www.webcitation.org/6xryAZj8C on 12 March 2018).
4. Center for Behavioral Health Statistics and Quality. Behavioral health trends in the United States: Results from the 2014 National Survey on Drug Use and Health (HHS Publication No. SMA 15–4927, NSDUH Series H-50). 2015. Available at: http://www.samhsa.gov/data/ (accessed 1 May 2017) (Archived at http://www.webcitation.org/6xryN1aSw March 2018).
5. Office of Applied Studies. *National and State Estimates of the Drug Abuse Treatment Gap: 2000 National Household Survey on Drug Abuse*, NHSDA Series H-14, DHHS Publication no. SMA 02–3640. Rockville, MD: Substance Abuse and Mental Health Services Administration; 2002.
6. Wu L.-T., Zhu H., Swartz M. S. Treatment utilization among persons with opioid use disorder in the United States. *Drug Alcohol Depend* 2016; **169**: 117–27.
7. Saloner B., Karthikeyan S. Changes in substance abuse treatment use among individuals with opioid use disorders in the United States, 2004–2013. *JAMA* 2015; **314**: 1515–7.
8. McLellan A. T., Lewis D. C., O'Brien C. P., Kleber H. D. Drug dependence, a chronic medical illness. *JAMA* 2000; **284**: 1689–95.
9. Hser Y., Hoffman V., Grella C. E., Anglin M. D. A 33-year follow-up of narcotics addicts. *Arch Gen Psychiatry* 2001; **58**: 503–8.
10. Nelson P. K., Mathers B. M., Cowie B., Hagan H., Des Jarlais D., Horyniak D., *et al.* Global epidemiology of hepatitis B and hepatitis C in people who inject drugs: results of systematic reviews. *Lancet* 2011; **378**: 571–83.
11. Mathers B. M., Degenhardt L., Phillips B., Wiessing L., Hickman M., Strathdee S. A. *et al.* Global epidemiology of injecting drug use and HIV among people who inject drugs: a systematic review. *Lancet* 2008; **372**: 1733–45.
12. Rudd R. A., Seth P., David F., Scholl L. Increases in drug and opioid-involved overdose deaths—United States, 2010–2015. *Morb Mortal Wkly Rep* 2016; **65**: 1445–52.
13. Birnbaum H. G., White A. G., Schiller M., Waldman T., Cleveland J. M., Roland C. L. Societal costs of prescription opioid abuse, dependence, and misuse in the United States. *Pain Med* 2011; **12**: 657–67.
14. Kolodny A., Courtwright D. T., Hwang C. S., Kreiner P., Eadie J. L., Clark T. W. *et al.* The prescription opioid and heroin crisis: a public health approach to an epidemic of addiction. *Annu Rev Public Health* 2015; **36**: 559–74.
15. Volkow N. D., Frieden T. R., Hyde P. S., Cha S. S. Medication-assisted therapies—tackling the opioid-overdose epidemic. *N Engl J Med* 2014; **370**: 2063–6.
16. Crowley R., Kirschner N., Dunn A. S., Bornstein S. S. Health and public policy to facilitate effective prevention and treatment of substance use disorders involving illicit and prescription drugs: an American College of Physicians position paper. *Ann Intern Med* 2017; **166**: 733–6.
17. Office of National Drug Control Policy. Medication-assisted treatment for opioid addiction. Executive Office of the President. 2012. Available at: http://www.whitehouse.gov/ONDCP (accessed 1 May 2017) (Archived at http://www.webcitation.org/6xrydYkZj on 12 March 2018).
18. Pecoraro A., Ma M., Woody G. E. The science and practice of medication-assisted treatments for opioid dependence. *Subst Use Misuse* 2012; **47**: 1026–40.
19. Kresina T. F., Lubran R. Improving public health through access to and utilization of medication assisted treatment. *Int J Environ Res Public Health* 2011; **8**: 4102–17.
20. MacArthur G. J., Minozzi S., Martin N., Vickerman P., Deren S., Bruneau J. *et al.* Opiate substitution treatment and HIV transmission in people who inject drugs: systematic review and meta-analysis. *BMJ* 2012; **345**: e5945.
21. Cousins G., Boland F., Courtney B., Barry J., Lyons S., Fahey T. Risk of mortality on and off methadone substitution treatment in primary care: a national cohort study. *Addiction* 2016; **111**: 73–82.
22. Sordo L., Barrio G., Bravo M. J., Indave B. I., Degenhardt L., Wiessing L. *et al.* Mortality risk during and after opioid substitution treatment: systematic review and meta-analysis of cohort studies. *BMJ* 2017; **357**: j1550.
23. Jones C. M., Campopiano M., Baldwin G., McCance-Katz E. National and state treatment need and capacity for opioid agonist medication-assisted treatment. *Am J Public Health* 2015; **105**: e55–e63.
24. Arfken C. L., Johanson C.-E., di Menza S., Schuster C. R. Expanding treatment capacity for opioid dependence with office-based treatment with buprenorphine: national surveys of physicians. *J Subst Abuse Treat* 2010; **39**: 96–104.
25. Greene P. Outpatient drug utilization trends for buprenorphine years 2002–2009. Buprenorphine Meeting, Washington DC, USA; 2010.
26. Compton W. M., Boyle M., Wargo E. Prescription opioid abuse: problems and responses. *Prev Med* 2015; **80**: 5–9.
27. White House Office of the Press Secretary. President Obama proposes $1.1 billion in new funding to address the prescription opioid abuse and heroin use epidemic. Available at: https://www.whitehouse.gov/the-press-office/2016/02/02/president-obama-proposes-11-billion-new-funding-address-prescription (accessed 29 April 2017) (Archived at http://www.webcitation.org/6y2E97JL1 on 19 March 2018).
28. McCarty D., Gustafson D. H., Wisdom J. P., Ford J., Choi D., Molfenter T., *et al.* The Network for the Improvement of

Addiction Treatment (NIATx): enhancing access and retention. *Drug Alcohol Depend* 2007; **88**: 138–45.
29. Molfenter T. Reducing appointment no-shows: going from theory to practice. *Subst Use Misuse* 2013; **48**: 743–9.
30. Gustafson D. H., Quanbeck A. R., Robinson J. M., Ford J. H., Pulvermacher A., French M. T. *et al*. Which elements of improvement collaboratives are most effective? A cluster-randomized trial. *Addiction* 2013; **108**: 1145–57.
31. Fields D., Knudsen H. K., Roman P. M. Implementation of Network for the Improvement of Addiction Treatment (NIATx) processes in substance use disorder treatment centers. *J Behav Health Serv Res* 2016; **43**: 354–65.
32. Gryczynski J., Schwartz R. P., Salkever D. S., Mitchell S. G., Jaffe J. H. Patterns in admission delays to outpatient methadone treatment in the United States. *J Subst Abuse Treat* 2011; **41**: 431–9.
33. Booth R. E., Corsi K. F., Mikulich S. K. Improving entry to methadone maintenance among out-of-treatment injection drug users. *J Subst Abuse Treat* 2003; **24**: 305–11.
34. Peterson J. A., Schwartz R. P., Mitchell S. G., Reisinger H. S., Kelly S. M., O'Grady K. E., *et al*. Why don't out-of-treatment individuals enter methadone treatment programmes? *Int J Drug Policy* 2010; **21**: 36–42.
35. Bao Y.-p., Liu Z.-M., Epstein D. H., Du C., Shi J., Lu L. A meta-analysis of retention in methadone maintenance by dose and dosing strategy. *Am J Drug Alcohol Abuse* 2009; **35**: 28–33.
36. Fullerton C. A., Kim M., Thomas C. P., Lyman D. R., Montejano L. B., Dougherty R. H. *et al*. Medication-assisted treatment with methadone: assessing the evidence. *Psychiatr Serv* 2014; **65**: 146–57.
37. Quanbeck A. R. Variation in the average cost of addiction treatment: an examination of process. Unpublished dissertation. The University of Wisconsin-Madison; 2012.
38. Gryczynski J., Schwartz R., O'Grady K., Jaffe J. Treatment entry among individuals on a waiting list for methadone maintenance. *Am J Drug Alcohol Abuse* 2009; **35**: 290–4.
39. Fatseas M., Auriacombe M. Why buprenorphine is so successful in treating opiate addiction in France. *Curr Psychiatry Rep* 2007; **9**: 358–64.
40. Ahamad K. An urgent call to increase access to evidence-based opioid agonist therapy for prescription opioid use disorders. *Can Med Assoc J* 2016; **188**: 1208–9.
41. Andrews C. M., Shin H.-C., Marsh J. C., Cao D. Client and program characteristics associated with wait time to substance abuse treatment entry. *Am J Drug Alcohol Abuse* 2013; **39**: 61–8.
42. Sigmon S. C. Interim treatment: bridging delays to opioid treatment access. *Prev Med* 2015; **80**: 32–6.
43. Harlow W., Happell B. M., Browne G., Choudhury J., Pinchin D. Triage in opioid replacement therapy: what's the wait? *Subst Use Misuse* 2013; **48**: 137–46.
44. Carroll K. M., Weiss R. D. The role of behavioral interventions in buprenorphine maintenance treatment: a review. *Am J Psychiatry* 2017; **174**: 738–47.
45. Dugosh K., Abraham A., Seymour B., McLoyd K., Chalk M., Festinger D. A systematic review on the use of psychosocial interventions in conjunction with medications for the treatment of opioid addiction. *J Addict Med* 2016; **10**: 91–101.
46. Lawental M. Effectiveness of rapid intake into methadone treatment: a natural experiment in Israel. *Eur Addict Res* 2015; **21**: 211–6.
47. Bammer G., Battisson L., Ward J., Wilson S. The impact on retention of expansion of an Australian public methadone program. *Drug Alcohol Depend* 2000; **58**: 173–80.
48. Maddux J. F., Desmond D. P., Esquivel M. Rapid admission and retention on methadone. *Am J Drug Alcohol Abuse* 1995; **21**: 533–47.
49. Hser Y. I., Saxon A. J., Huang D., Hasson A., Thomas C., Hillhouse M. *et al*. Treatment retention among patients randomized to buprenorphine/naloxone compared to methadone in a multi-site trial. *Addiction* 2014; **109**: 79–87.
50. Hser Y.-I., Evans E., Grella C., Ling W., Anglin D. Long-term course of opioid addiction. *Harv Rev Psychiatry* 2015; **23**: 76–89.
51. Arias E., Heron M., Xu J. United States life tables, 2012, national vital statistics reports: from the Centers for Disease Control and Prevention, National Center for Health Statistics. *Natl Vital Stat Syst* 2016; **65**: 1.
52. Bachireddy C., Weisberg J. D. F., Altice F. L. Balancing access and safety in prescribing opioid agonist therapy to prevent HIV transmission. *Addiction* 2015; **110**: 1869–71.
53. Krebs E., Kerr T., Montaner J., Wood E., Nosyk B. Dynamics in the costs of criminality among opioid dependent individuals. *Drug Alcohol Depend* 2014; **144**: 193–200.
54. Murphy S. M., Polsky D. Economic evaluations of opioid use disorder interventions. *Pharmacoeconomics* 2016; **34**: 863–7.
55. Knudsen H. K., Roman P. M. Financial factors and the implementation of medications for treating opioid use disorders. *J Addict Med* 2012; **6**: 280–6.
56. Quanbeck A. R., Madden L., Edmundson E., Ford J. H. II, McConnell K. J., McCarty D. *et al*. A business case for quality improvement in addiction treatment: evidence from the NIATx collaborative. *J Behav Health Serv Res* 2012; **39**: 91–100.
57. Loveland D., Driscoll H. Examining attrition rates at one specialty addiction treatment provider in the United States: a case study using a retrospective chart review. *Subst Abuse Treat Prev Policy* 2014; **9**: 41.
58. Han B., Compton W. M., Jones C. M., Cai R. Nonmedical prescription opioid use and use disorders among adults aged 18 through 64 years in the United States, 2003–2013. *JAMA* 2015; **314**: 1468–78.
59. Friedmann P. D., Andrews C. M., Humphreys K. How ACA repeal would worsen the opioid epidemic. *N Engl J Med* 2017; **376**: e16.

