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Research article

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Drug Treatment Court of Vancouver (DTCV): An Empirical Evaluation of Recidivism

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Drug treatment court effectiveness

Introduction

Internationally, justice systems have been forced to evolve in response to the dramatic increase in the population of drug-related offenders. The number of citizens incarcerated for drug offences in the United States increased ten-fold between 1980 and 2003 [1]. A more muted, but essentially similar trend was observed in Canada, where drug-related offences reached a thirty-year high in 2007 [2]. A notable innovation in this context has been the advent of Drug Treatment Courts (DTCs), which first emerged in 1989 in Dade County Florida. Founded on the principles of therapeutic jurisprudence [3], DTCs apply the authority of judges to reinforce engagement with drug treatment as a pathway leading to reduction in offending. If proven effective, DTCs would bring welcome relief from the superabundance of offenders charged with drug related crimes.

In 1998, the first DTC outside the United States was opened in Toronto, followed by a second Canadian court in Vancouver in 2001. There are presently six federally funded DTCs in Canada [4]. Beyond North America, DTCs are now part of the national drug control strategies in the UK [5], Australia [6] and New Zealand [7]. Despite the trend to greater internationalization of DTCs, the overwhelming majority of outcome research is derived from programs operating in the United States. Our study seeks to extend the growing fund of knowledge concerning drug courts to the Canadian setting, with its distinct drug-related laws, judicial procedures, and population.

Drug treatment court objectives and methods

The primary goal of DTC's is to improve public safety through the reduction of criminal recidivism. Fulfillment of this goal is predicated on a series of assumptions, including: that treatment for substance abuse is an effective means of reducing substance use and related criminal behaviour; that intensive and frequent judicial supervision is an effective means of ensuring compliance and participation in treatment; and that integrating treatment and court processes within a singular model will be more effective than operating the two systems separately (Canadian Centre on Substance Abuse [8]; Weeks, et al. [9]). Based on these assumptions, DTCs offer opportunities for suitably motivated individuals to address the substance abuse problems that presumably mediate their criminal behaviour [10].

Drug treatment court policy in Canada follows the principles for court directed treatment outlined by the United Nations Office on Drugs and Crime [11], which stipulate an integrated, non-adversarial approach that offers a broad continuum of treatment and rehabilitation services, ongoing interaction between the client and the DTC team, and the development of partnerships between DTC teams with local and specialized service providers [11]. Recent research has begun to systematically examine the structural and operational aspects of DTCs that may be associated with program effectiveness [12]. However, a separate, and arguably more fundamental research question concerns the relationship between DTC's and public safety. To date there have been no published studies reporting the effectiveness of Canada's DTC's as a means of reducing recidivism among offenders.

In their meta-analysis of DTC effects on recidivism, Latimer, Morton-Bourgeon and Chretien [4] concluded that DTCs reduced recidivism by 14% compared to conventional justice system responses. In another meta-analysis, Wilson, Mitchell, and MacKenzie [13] reached a similar conclusion, finding that DTC's were responsible for a reduction in offending of 14% when considering only high-quality studies. A more recent meta-analysis included only studies with robust methodologies [14] and concluded that the least biased estimate of DTCs on reducing recidivism was a more modest 8%. In the process of their review, Gutierrez and Bourgon [14] identified two major methodological flaws that commonly recurred in primary research on DTCs: failure to use an intent-to-treat analysis (e.g., analyzing program graduates only); and pre-existing differences between treatment and comparison groups.

Analysis of several DTCs in the United States found graduation rates ranging from 29% to 48%, rates that are similar to or slightly greater than those observed in comparable outpatient drug treatment programs [15]. Programs ranging from 12 to 18 months in duration appear to be most effective, compared to both shorter and longer programs. Despite high initial rates of program drop out and non-completion, for those individuals who manage to graduate from DTC, recidivism rates are lower compared to those sentenced through the traditional court system [4].

A common challenge in designing an evaluation scheme for DTCs is the establishment of a valid and meaningful comparison group. Previous unpublished evaluations of the Toronto and Vancouver DTCs have been substantially critiqued on the basis of methodological weaknesses, including limited follow up durations and unmatched comparison groups [16,17]. Randomized controlled trials (RCTs) would be the preferred methodology in this context. However, in Canada a legal foundation exists to challenge randomization when there is a reasonable expectation that different proceedings will influence the outcome of cases. In the absence of random assignment, the reduction of selection bias and accounting for confounders are crucial methodological considerations in establishing a comparison group.

In addition to true experimental designs (e.g., Gottfredson, Najaka, Kearley, & Rocha, 2006), recent research examining DTC participation and post-intervention offending has been conducted using quasi-

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experimental techniques. Strategies to address selection bias have included matching clients through eligibility criteria and controlling for demographic factors associated with criminal behaviour, such as age, race/ethnicity and gender [18,19]. In addition, an intent-to-treat (ITT) analytic approach has been employed in some recent studies to avoid attrition bias associated with examining only program completers or "graduates" [18,19]. However, the use of this approach is not well established. Fewer than 30% of the DTC studies reviewed by Gutierrez and Bourgon [14] employed the ITT method.

Follow-up periods have generally ranged from 6-12 months post-program completion or discharge [20-23], or up to 2+ years following program enrollment [19,24]. In a study assessing the long-term impact of DTC participation on recidivism, a repeated measures framework was used to examine seven 6-month time periods (30 months total follow-up, initiated 12 months prior to baseline), also controlling for maturation bias [18]. Different measures of recidivism have been used across studies, including prosecutorial action [19], number of jail days 12 months post-discharge [21], number of arrests, rearrests and/or offence severity [18,20,22-24]. Sources of recidivism data have included court records [21], State Departments of Corrections and Law Enforcement [18,24], and State Justice Information System databases [19,20,22,23]. As a measure of recidivism following DTC, the use of sentencing data has some advantages, representing a finding of guilt, and also reflecting a relatively large investment of justice system resources. By contrast, changes in arrest rates may be subject to differences in policing as a function of DTC participation.

Propensity Score Matching

As an alternative to randomization, the propensity score matching (PSM) method allows for adjustments to minimize the impact of confounding variables in observational research [25]. This method has been shown to be effective in the context of evaluating DTCs [23,24,26] as well as other justice system innovations where randomization is not viable [27], including mental health courts [28], family drug treatment courts [29] and a variety of other judicial innovations employing the use of suspended sentences [30].

The validity and robustness of a comparison group that is created using the PSM method is dependant on the quality and completeness of the variables that are available for inclusion in the matching procedure. Most previous justice system evaluations using PSM have incorporated variables reflecting demographic characteristics of offenders and offence-related measures. An influential study by Rempel, et al. [26] used the PSM method to evaluate recidivism impacts associated with eleven DTCs in New York State. Participants were matched on the basis of numerous variables associated with criminal recidivism. However, measures of socioeconomic status, drug use, mental disorders, or physical health were not available to the researchers and therefore could not be included in the matching algorithm. In the NY study the inclusion of these variables may not have been necessary in order to control for factors associated with the primary outcome (i.e., criminal recidivism). However, in the case of the Vancouver DTC, poverty, illness, and mental health are quite plausibly related to the probability of drug use, and the likelihood of arrest, and therefore need to be taken into account.

DTC Client and Program Characteristics

Several client-level characteristics are positively correlated with successful completion of DTC programs, such as older age, higher levels of education and being married [31]. Not surprisingly, these same factors have been shown to be predictive of positive outcomes

in substance abuse treatment outside of DTCs, as well as greater likelihood of offender rehabilitation in other areas of the criminal justice system [32]. Notwithstanding their over-representation in the justice system, men are more likely than women to graduate from DTC, perhaps because women tend to come into contact with the corrections system at a point where they are further entrenched in the drug crime lifestyle than men [31]. In Canada, individuals of Aboriginal ethnicity are grossly over-represented in justice systems [33], and are beset by numerous social inequities that adversely effect recovery from substance use and reintegration following correctional involvement [34].

Differences in the characteristics of offenders between courts may have implications for the design and delivery of DTC programs. The theory of Risk-Need-Responsivity (RNR) has considerable importance in the domain of correctional programming, and is founded on practices that empirically match offenders' characteristics to treatment programs [35]. Recent evidence suggests that adherence to the principles of RNR is associated with greater reductions in recidivism among DTCs [14].

The model of service provided by the DTC of Vancouver (DTCV) is informed by over a decade of experience. However, there is no independent empirical evidence to guide (or validate) the service mix and methods used by the Vancouver DTC with their clients. Moreover, the effectiveness of the DTCV in relation to reducing recidivism is unknown.

Vancouver Drug Treatment Court History

The DTCV operates in the Provincial Court facility in the neighborhood known as the Downtown Eastside, Canada's poorest neighborhood. Drug-related problems are well documented in the Downtown Eastside. Needle sharing practices have contributed to epidemic levels of infectious disease [36], and the Vancouver police chief has described the area as "ground zero for property crime" [37].

The DTCV began operations in December of 2001, initially operating as a pilot project. The program serves a population of individuals who have long histories of criminal offending, and who reside in the Downtown Eastside. Unlike DTCs that utilize existing services in the community, Vancouver has the only DTC in Canada with an integrated treatment team that is singularly focused on the needs of DTC participants.

Aspects of the DTCV's operations have evolved based on the experience of the program. Initially, inclusion was restricted to participants who were charged with drug-related offences under Canada's Controlled Drug and Substances Act (CDSA). This criterion was later relaxed to include participants charged with a broader range of offences, including violent crimes. Candidates are screened to confirm that their offending is related to substance dependence. During its' first years of operation, the in-house resources of the program were centered on addiction treatment, which was provided under contract. This service model was revised and expanded in August 2006 with additional full-time staff members representing nursing, probation, and social assistance. Additional human resources providing Aboriginal care and housing support were also added. These changes were implemented to better meet the needs of participants, and were created through new partnerships with the major publicly-funded agencies responsible for providing health and social assistance services in the Vancouver region.

Hypotheses and approach of the current study

Our primary hypothesis is that the Vancouver DTC produces

reductions in offending, and specific reductions in drug-related offending, when compared to the traditional administration of justice. Our research includes a larger array of matching variables than have been used in previous studies on DTCs, including criminogenic factors, medical, socio-economic, corrections system, and demographic variables. This is the first study to utilize the PSM for research on a Canadian DTC. We use the ITT approach, with follow up data for 24 months following discharge or completion.

Methods

Data sources

Data for the present study were provided through the British Columbia Inter-Ministry Research Initiative (IMRI). The purpose of the IMRI is to create and maintain an information resource that can support the evaluation of multi-agency programs. Our analyses utilize non-identifying linked administrative data, contributed by three independent Provincial government Ministries: Public Safety and Solicitor General (PSSG); Health Services (MOHS); and Social Development (MSD). The same data sources are used to conduct both the PSM and final outcome analyses.

Data from the contributing Ministries comprise a relatively complete inventory of the health, corrections, and income assistance services used by members of the British Columbia population. The completeness of these data reflects the central organizational and funding role provided by the Provincial government in the administration of these various services. The current analysis uses linked data spanning from 1997 to 2010.

This study was reviewed and approved by the Research Ethics Board of Simon Fraser University.

Participants

Participants were included if they were enrolled in the DTCV between its inception in Dec 2001 and November 2008, and regardless of whether they were eventually discharged, withdrawn, or graduated from the program as of March 31, 2009. We excluded individuals who died during their involvement with the program, and restricted inclusion to individuals who exited the DTCV by Mar 31 2009, ensuring at least 12 months of follow-up data for each participant. We also excluded participants due to multiple admissions and/or if they were currently active in the program.

A propensity score was calculated for the DTC cohort involving the following six categories of variables.

1. Demographics: age, gender, ethnicity, education.
2. Criminogenic factors, assessed through the Community Risk Needs Assessment [38]. This measure is administered by corrections and is based on the Risk Need Responsivity Model [39]. Separate scores represent Overall Supervision level, Behavioural and Emotional Stability, and Substance Abuse.
3. Correctional history in the two years prior to DTCV: number of violent offences; number of breach offences (e.g., failure to comply with a court order); number of property offences.
4. Community health services in the two years prior to DTCV: costs of community medical services for a diagnosed mental disorder; costs of community medical services for a diagnosed substance use disorder; costs of community medical services for any other illness or condition.

5. Hospital days in the two years prior to DTCV: for a mental disorder; for a substance use disorder; for any other illness or condition.
6. Inclusion in the Provincial database for alcohol and drug services: yes/no. This database includes individuals who receive services through publicly funded community-based alcohol and drug treatment agencies.
7. Social assistance in the two years prior to DTCV: total costs paid for disability, financial need, or any other eligible benefit.

Eligibility for inclusion in the comparison group was restricted to individuals who had been sentenced through the same court facilities where the DTCV is located in the Downtown Eastside of Vancouver, between the dates of Apr 2003 and Mar 2009. We also excluded participants who were younger than 18 years at the enrolment date, which was April 1, 2005 for the comparison pool. These restrictions were instituted to ensure a contemporaneous sample from the same location.

Baseline and follow-up periods

In order to calculate baseline values for services (e.g., sentences, hospitalizations), we included all events occurring in the two-year period prior to enrollment in the DTC for the intervention group, or the two-year period prior to the enrolment date (March 31, 2005) for the comparison group. Follow-up periods commenced at the termination of DTC involvement (i.e., graduated, withdrawn, discharged). Follow up for the comparison group extended from April 2007 to March 31, 2009. Dependent measures in our analyses were overall recidivism and drug-related recidivism (i.e., CDSA offences), including only those charges that resulted in convictions.

Propensity Score Method (PSM) was applied to identify the comparison group from the comparison pool using the nearest neighbor technique (one-to-one matching) without replacement. Propensity score (logit form of the predicted probability) was obtained from the multivariable logistic regression using drug court membership as a dependent variable and all the matching variables as predictors.

The Stata module 'PSmatch2' was used to draw the comparison group and to check balances of matching variables [40]. Student t test, McNemar's test, and Chi-square test as appropriate were used to compare continuous and nominal data between DTCV cohort and comparison group before and after matching. Participants with missing values were excluded from the analysis.

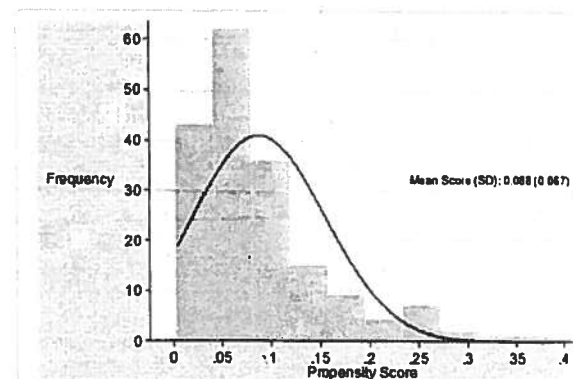


Figure 1: Propensity Score: DTCV Participants (n=180).

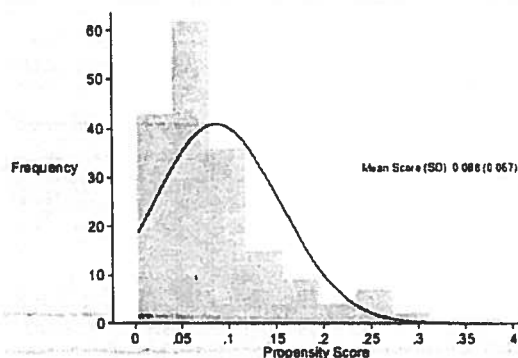


Figure 2: Matched Comparison Participants (n=180).

	DTCV Cohort (n=180)	Unmatched Control (n=4687) ¹	Matched Comparison Group (n=180)	Test Statistics ² (DTCV Cohort vs. Matched Group)	P value (DTCV Cohort vs. Matched Group)
Age at enrolment in years					
Mean (SD)	35.4 (9.7)	34.6 (9.7)	36.0 (9.6)	0.617	0.537
Gender					
Male	127 (71)	4114 (88)	135 (75)	0.897	0.343
Female	53 (29)	573 (12)	45 (25)		
Ethnicity					
Caucasian	96 (53)	2854 (61)	85 (47)	2.326	0.313
Aboriginals	53 (29)	795 (17)	53 (29)		
Other	31 (17)	1038 (22)	42 (23)		
Education level					
Grade 9 or less				1.423	0.700
Grade 10/11	37 (20)	665 (14)	30 (17)		
Grade 12	68 (38)	1652 (35)	77 (43)		
Vocational /University	59 (33)	1611 (34)	59 (33)		
	16 (9)	759 (16)	14 (8)		

Table 1: Comparison of Socio-demographic Characteristics between DTCV Participants and Comparison Group.

Results

Among the DTCV cohort, 180 cases that met our inclusion criteria and had no missing values were included in our analyses. The comparison pool included 4687 cases, from which a matched comparison group (n=180) was selected using PSM.

Sample characteristics and propensity score distribution

Histograms representing the distribution of propensity scores for the DTC cohort and the matched comparison group are shown in Figure 1 and Figure 2.

Significance tests were conducted to examine the baseline comparability of the DTCV cohort and the matched comparison group.

Members of the DTCV cohort did not differ significantly from the broader offender population (in the same Provincial court) on the basis of mean age (about 35 years). However, the DTCV group included a significantly greater percentage of females (29% versus 12%) than the unmatched comparison group. The DTCV cohort also included a significantly higher percentage of Aboriginal people (29% versus 17%) and was significantly less well educated than the unmatched comparison group (see Table 1). The PSM process resulted in no significant differences between DTCV and matched comparison groups on these demographic variables.

Offending histories differed between DTCV and unmatched comparison groups in the two years prior to DTCV enrollment (or the two years prior to sentencing) on both violent offences (significantly lower in DTCV) and Breach offences (significantly higher in DTCV). No differences on property offences were observed between groups. The DTCV and matched comparison groups did not differ significantly on any of these categories of offending (see Table 2).

The Community Risk Need Assessment includes subscales reflecting Overall Supervision level, Behavioural and Emotional Stability, and Substance Abuse. DTCV participants were successfully matched with comparison group members on all CRNA measures. The DTCV cohort did not differ significantly from the unmatched offender group on either the Overall Supervision or the Behavioural and Emotional Stability scales. Significant differences were observed on the Substance Abuse scale, with DTCV participants (and the matched comparison group) having higher percentages with a "severe problem" or "some problem", and a lower percentage with "no problem". Nearly half (47%) of the DTCV cohort was assessed as having a "severe problem" with substance abuse.

Health and social assistance variables are presented in Table 3. The DTCV cohort and the matched comparison group did not differ significantly on any of the variables discussed in this section. Medical Services Plan (MSP) payments (in Canadian Dollars) reflect the costs of physician services that were provided in the community (i.e., primary healthcare and specialist consultations) and are reported for three diagnosis-related areas of services. Compared to the unmatched group, the DTCV cohort was associated with significantly lower costs for MSP services concerning a diagnosed Mental Disorder (mean=\$152 versus \$247).

We examined days in hospital during the two-year Baseline period. Compared to the unmatched group, the DTCV cohort spent significantly fewer days in hospital for diagnoses involving a Substance Use Disorder, but a significantly greater number of days hospitalized for Other Diagnosed conditions (see Table 3).

Social Assistance Payments are provided to individuals who satisfy criteria of financial need, including physical and mental disabilities. Members of the DTCV cohort received significantly greater support (in Canadian Dollars) when compared to the unmatched group.

Outcomes/effects of dtcv on recidivism

For each group we compared offences in the pre and post periods for all offences, and for the subset that were classified under Canada's Controlled Drugs and Substance Act (CDSA). Differences in offending between the pre and post periods were compared between groups (i.e., difference between differences). Between the pre and post periods all measures of offending decreased in each group (see Table 4). The magnitude of the reduction in total offending was significantly greater in the DTCV cohort than in the Matched Comparison Group. For drug-related offences (i.e., CDSA), the DTCV cohort exhibited highly significant reductions when compared to the Matched Comparison Group (see Table 4).

We examined the number of people (and percentages of each cohort) who were sentenced at least once during the two-year baseline period and the corresponding number (and percentages) during the two-year post-program period. As shown in Table 4, the percentage of people in the DTCV cohort who committed any offence decreased significantly from 78% to 51%, with a similar significant decrease in the matched comparison group, from 72% to 49%. Odds ratios and

	DTCV Cohort (n=180)	Unmatched Control (n=4687) ^a	Matched Control (n=180)	Test Statistics ^a (DTCV Cohort vs. Matched Group)	P value (DTCV Cohort vs. Matched Control)
Number of Violent offences in pre-program (2 yrs) period Mean (SD)	0.04 (0.19)	0.53 (1.13)	0.03 (0.18)	<0.001	1.00
Number of Breach offences in pre-program (2 yrs) period Mean (SD)	1.05 (1.87)	0.73 (1.72)	1.00 (3.05)	0.187	0.851
Number of Property offences in pre-program (2 yrs) period Mean (SD)	1.41 (2.97)	1.75 (3.30)	1.08 (2.10)	1.188	0.236
CRNA: Overall Supervision level	24 (13)	906 (19)	31 (17)	1.090	0.580
Low	82 (46)	2050 (44)	80 (44)		
Medium	74 (41)	1731 (37)	69 (38)		
High					
CRNA: Behavioral and Emotional Stability				1.163	0.559
No problem	44 (24)	1434 (31)	51 (28)		
Some problem	105 (59)	2346 (50)	104 (58)		
Severe problem	31 (17)	907 (19)	25 (14)		
CRNA: Substance Abuse				2.381	0.304
No problem	25 (14)	1711 (38)	26 (14)		
Some problem	70 (39)	1575 (34)	83 (46)		
Severe problem	85 (47)	1401 (30)	71 (40)		

Table 2: Comparison of Correction-related Characteristics between DTCV Participants and Comparison Group During Baseline.

	DTCV Cohort (n=180)	Unmatched Control (n=4687) ^a	Matched Control (n=180)	Test Statistics ^a (DTCV Cohort vs. Matched Group)	P value (DTCV Cohort vs. Matched Control)
MSP payment related to Mental Disorder diagnosis in pre-program (2 yrs) period Mean (SD)	152 (379)	247 (831)	145 (438)	0.169	0.866
MSP payment related to Substance Use Disorder diagnosis in pre-program (2 yrs) period Mean (SD)	209 (420)	194 (501)	218 (487)	0.183	.855
MSP payment related to other diagnosis in pre-program (2 yrs) period Mean (SD)	1068 (1420)	916 (1494)	944 (1378)	0.839	0.402
Number of Hospital days related to Mental Disorder diagnosis in pre-program (2 yrs) period Mean (SD)	0.22 (1.83)	1.85 (27.3)	0.47 (4.91)	0.640	0.523
Number of Hospital days related to Substance Use Disorder diagnosis in pre-program (2 yrs) period Mean (SD)	0.09 (0.68)	0.30 (2.66)	0.04 (0.28)	1.016	0.310
Number of Hospital days related to other diagnosis in pre-program (2 yrs) period Mean (SD)	2.86 (10.47)	2.20 (11.90)	2.31 (10.57)	0.496	0.620
Total Assistance payment from SD ministry in pre-program (2 yrs) period Mean (SD)	8326 (6607)	5821 (7340)	8586 (8574)	0.323	0.747
Any activity with Addiction Information Management system				0.199	0.655
No	152(84)	4056 (87)	155 (86)		
Yes	28 (16)	631 (13)	25(14)		

Table 3: Comparison of Health and Social Service Utilization related Characteristics between DTCV Participants and Comparison Group During Baseline.

95% confidence intervals for these comparisons in the DTCV and matched group were 4.8 (2.6, 9.5) and 2.2 (1.4, 3.4) respectively. The effect size (standardized mean difference) for the overall difference in offending between groups was 0.21%. Within the overall category of offending, 63% of the DTC cohort had committed at least one drug-related offence in the pre-period, which decreased significantly to 28% in the two-year post period. The corresponding change in the matched comparison group was a non-significant reduction from 21% to 14%. Odds ratios and 95% confidence intervals were 6.3 (3.4, 12.6) and 1.7 (0.9, 3.3) for the DTCV and matched group respectively.

Discussion

Participants in the DTCV exhibited significantly greater reductions

in offending than a matched comparison group that received the traditional administration of justice in the same location. Our results indicate that the DTCV was associated with reduced overall offending, including reductions in offences involving drug violations. The observed program effects are similar in magnitude to those reported by recent reviewers of DTC outcomes on client recidivism [13,14].

Overall, the DTCV cohort exhibited an average reduction of 0.95 offences per person per year, and a reduction in drug-related offences of 0.42 per person per year. The number of unique DTCV participants who were sentenced for drug-related charges decreased by over fifty percent in the two years following their involvement with the program. These results are impressive due to the clustering of social

	DTCV Cohort (n=180)	Matched Comparison Group (n=180)	Test Statistics ^a (DTCV Cohort vs. Matched Group)	P value (DTCV Cohort vs. Matched Group)
Annualized Changes of offences between pre and post program				
Mean (SD)	0.95 (2.19)	0.46 (2.52)	1.999	0.046
Annualized Changes of CDSA related offences between pre and post program period				
Mean (SD)	0.42 (1.00)	0.05 (0.49)	4.394	<0.001
Any offence in pre (2 yrs) and post-program (2 yrs) period				
Pre-period	141 (78)	129 (72)	30.720	<0.001 ¹¹
Post-period	92 (51)	89 (49)	14.063	<0.001 ¹²
Odds Ratio (95% CI)	4.8 (2.6, 9.5)	2.2 (1.4, 3.4)		
Any CDS related offence in pre (2 yrs) and post-program (2 yrs) period				
Pre-period	113 (63)	38 (21)	44.184	<0.001 ¹⁴
Post-period	50 (28)	25 (14)	2.939	0.085 ¹⁵
Odds Ratio (95% CI)	6.3 (3.4, 12.6)	1.7 (0.9, 3.3)		

Table 4: Comparison of outcome between DTCV Participants and Comparison Group.

disadvantages among members of the cohort (discussed below), and due to the inclusion of all enrollees in our analyses (i.e., intent to treat method).

We used the propensity score matching (PSM) method to create a comparison group, and were able to simultaneously match individuals on a range of variables, including demographic and historical factors (health, welfare, and justice service use). Our PSM method included prospective ratings concerning the risk of recidivism, derived from the Community Risk Need Assessment (CRNA), which is an empirically validated instrument [37] based on the Risk Need Responsivity (RNR) model [39,41]. The CRNA is administered by probation officers, and the results inform interventions with the goal of promoting community safety and offender rehabilitation. Inclusion of the CRNA in matching is particularly relevant given that recidivism is a primary outcome of interest in our analyses. Nearly one half (47%) of the DTC cohort was assessed at baseline as having a "severe" risk of recidivism related to substance abuse.

Our findings add to the growing evidence that supports the effectiveness of DTCs in relation to the goal of reducing recidivism [4]. In particular, our findings extend the effectiveness of DTCs to a Canadian context, using an integrated and dedicated drug treatment service with an entrenched addicted population. Our study design is strengthened by the inclusion of relatively long baseline (2 years) and follow up (at least 1 year) periods, and by the integration of a broad range of relevant matching variables. Apart from their role in the propensity score algorithm, matching variables served to identify several important characteristics of DTCV participants in Vancouver's Downtown Eastside. In comparison to the general offender population in the same neighbourhood, DTCV participants included people with significantly lower educational achievement; significantly higher proportions of females and Aboriginal people; significantly higher per capita disability support and a greater numbers of hospital days prior to entering DTC. Taken in aggregate, these characteristics are prognostic of poorer responsiveness to justice and substance-related interventions Ashley et al. (2003), [42] and suggest that the local adaptations of the DTCV, including Aboriginal liaison services, financial assistance and housing supports, may be mediators of the program's outcomes. Our results do not address the relative effectiveness of individual program elements, and considerable future research on DTCs is needed to clarify the specific practices and procedures that maximize benefits to participants with different needs.

Our study reports differences between DTCV and a matched group in the co-located Provincial court. The generalizability of our

findings to other settings is related to the degree of similarity between our location and others, including the characteristics of participants, and the operations of both the DTCV and the Provincial court. An empirical approach to the refinement of DTCs in Canada requires scientific analysis of the site-specific characteristics of offenders, and the specific differences between DTCs and their comparators (i.e., "usual services") as they relate to differences in outcome, including differences in cost effectiveness. Such evidence does not yet exist, and in its' absence there is reason to question whether results favouring DTCs could be rivaled by increasing the availability of needed services and supports (e.g., community addiction treatment, supported housing) alongside the usual administration of justice.

Despite the inclusion of a relatively robust propensity score matching method, this study used an observational cohort design and has related limitations. The percentage of DTCV and matched comparison group members with any offense in the baseline period did not differ significantly, but the groups did differ with respect to drug-related offences. This specific baseline difference reflects the fact that CDSA offences were an inclusion criterion for the DTCV in the first several years of its' operations, and therefore the concentration of such offences within the cohort is not unexpected. We used justice and non-justice variables to match on the likelihood of recidivism, and the prevalence of substance use. Within groups, it remains impressive that the matched comparison group exhibited no significant reduction in drug-related offending, while the DTCV cohort decreased by over fifty percent.

Existing literature, including our study, does not address baseline levels of motivation for change among offenders. Future research is needed to examine whether readiness for change is meaningfully associated with the decision to enter DTC, and how DTC involvement interacts with participant motivation to mediate individual outcomes such as program completion (i.e., "graduation").

The present study is the first empirical evaluation of a Canadian DTC using propensity score matching, an intent-to-treat method, and multi-year data from health, corrections, and social welfare sectors. Our results support the effectiveness of the Vancouver DTC program, and confirm that the DTC model can achieve significant results within the Canadian judicial context while serving a population with diverse and complex needs.

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