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Correlates of residential detoxification completers and non-completers in Alberta

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Abstract

Objectives We aimed to identify factors correlated with completion, non-completion and cycling between completion and non-completion among clients admitted to Alberta Residential Withdrawal Management Services.

Methods The study included data on clients from a provincial database ($N = 20,020$) admitted to residential withdrawal management units across Alberta between April 1, 2015, and March 31, 2022. We collapsed admission-level data into client-level data, where each individual's information is captured as a unique record. Multinomial logistic regression was performed to investigate correlates of completion, non-completion, and multiple cycles of completion and non-completion. Clients in these three categories were compared in their socio-demographics, primary substance of concern, and other program variables of admission count, length of stay, transition to treatment, facilities utilized, days of discharge, and years of admission.

Results The study sample included 39,952 admissions, with an average of two per client. Overall, 55.8% ($n = 11,170$) of discharged clients completed the program, 25.5% ($n = 5,106$) were non-completed, and 18.7% ($n = 3,744$) cycled between completion and non-completion. Regression analysis indicated that clients who used a single substance, primarily alcohol, cocaine and marijuana, completed post-secondary education, were employed or had unstable employment, and were married had lower odds of non-completion. Other variables related to higher odds of completion were urban residence, multiple admissions to a facility, and longer lengths of stay. Conversely, clients who primarily used amphetamines, barbiturates, crystal meth, opiates, and tranquilizers had higher odds of non-completion. Female gender, being discharged on Saturday and Sunday, using detoxification as a standalone service without transitioning to residential treatment and admission to two or more facilities also correlated with higher odds of non-completion.

Conclusion Results indicated that the type of substances, gender, education, marital status, employment, place of residence, and transition to residential services were associated with detoxification outcomes. These findings can inform the customization and allocation of services, targeted support, service intensity and areas requiring additional attention and investment to improve treatment outcomes.

Keywords Completion, Non-completion, Correlates, Demographic, Program, Detoxification

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Introduction

Detoxification is often the necessary first step along a continuum of care to long-term recovery from addiction [1–3] to reduce the severity of withdrawal symptoms that could be both psychological [4] and physiological [5, 6]. Detoxification is ideally followed by initiating treatment and promoting continued abstinence [5, 7–10]. Despite the short-term value of detoxification in reducing addiction-related harms [11], it is rarely adequate to maintain abstinence and long-term recovery without subsequent long-term treatment [10, 12–14].

Completing detoxification services, as the first crucial step towards recovery and remission of symptoms of substance use disorder [15], predisposes improved outcomes with its potential to facilitate follow-up treatment [10, 16–20] or aftercare support [21, 22]. Furthermore, clients who complete detoxification have lower relapse rates [22] and improved quality of life regardless of subsequent relapses [23]. However, numerous studies showed that up to 63% of clients who entered a detoxification unit did not complete the program [24–27]. Retaining clients until completion is one of the major challenges of detoxification services [2].

A high non-completion rate from detoxification presents a barrier to recovery management [1, 25, 28, 29] and is associated with a greater likelihood of relapse after detoxification and a lower likelihood of entering abstinence-based treatment [7, 25]. Our study aimed to assess the characteristics of people not ready to complete detoxification services and understand the reasons for attrition. Our findings may help healthcare planners address the issues that lead to lower completion rates [30] and generate evidence-based targeted interventions to prevent non-completion [31].

Although the extant literature has established a significant relationship between detoxification completion/non-completion rates and various demographic, socioeconomic, substance use disorder and behavioural addiction,¹ program delivery, and systemic factors, the findings remain ambiguous due to differences in program settings; the populations studied and variability in the length of stay (LOS) measured in the number of days. These differences make model development for the correlation of completion problematic. This gap was echoed recently in a scoping review that found variability in the definition of non-completion examined [19]. As substance use disorder is a chronic disease, multiple detoxifications and relapses are common, where clients go through a cycle

of completion and non-completion² before transitioning to long-term treatment [32]. However, previous studies only compared non-completers versus completers and never studied clients in a cycle of completion and non-completion.

With a dichotomized completion outcome (i.e. complete vs. do not complete), previous studies found that lower completion and higher non-completion rates were associated with the following demographic factors: lower educational attainment [8, 18, 33]; being single [34]; misusing opiates [6, 35–38]; using poly-substance other than alcohol [6, 8, 36, 39]; being younger [2, 6, 8, 21, 30, 40, 41]; being either an Indigenous female or non-Indigenous males [36]; being unemployed [8, 30]; and, having few (average of 1.52) previous admissions to detoxification [2]. Factors that correlated with completion included a longer LOS [1, 18, 21, 25, 31, 42] and detoxing primarily from alcohol [8, 24, 37]. While Barnaby and Gibson [43] discovered that non-completion was uninfluenced by gender, age, marital status, educational attainment, employment status, and clients' place of origin, others reported contradictory results on the relationship between detoxification completion/non-completion and the number of previous admissions [2, 26, 30], gender [30], days of admission/discharge [6, 41, 42], and age [37].

While these studies provide valuable insights, it is unclear whether the realities observed in the international literature can be translated into a Canadian setting where healthcare access is universal. The variability of results and contradictions warrants investigating the correlations of completion and non-completion in the Canadian context. In Canada, detoxification services and completion/non-completion need to be better understood to ensure they produce the best outcomes for clients' recovery trajectories and make optimal use of available resources. Public investment in detoxification programs is cost-effective in reducing harm to users, their families, and society [24]. However, it is also one of the most common and expensive per-day treatment pathways [44]. The estimated cost of a detoxification episode ranges from \$3,625 to \$7,250 in Canada [45], whereas a mean admission cost of \$1,779 was recorded in the USA [46]. Non-completion of detoxification increases the likelihood of readmission, which subsequently raises the cost of detoxification. Despite the role of detoxification in the reduction of individual and societal costs associated with addiction [47], it has not been widely studied in Canada [48]. A handful of peer-reviewed articles have been published on detoxification completion/non-completion,

¹ In this manuscript, "behavioural addiction" refers specifically to gambling behaviour.

² The completion and non-completion cycle refers to individuals who completed some admissions while not completing others during the study period from 2015 to 2022.

including studies from British Columbia on detoxification completion [36], non-completion [6, 35], and correlates of patients leaving against medical advice from inpatient detoxification services in a single Ontario hospital with data covering over two years [31]. Our study is the first in Canada to examine the detoxification of adults across multiple publicly funded centres across a provincial health system. This study aims to determine the rate and correlates of completion or non-completion in publicly funded residential detoxification programs across Alberta from 2015 to 2022. The University of Alberta Research Ethics Board (REB) protocol No Pro00108773 approved the study.

Method

Study setting and design

This retrospective research used administrative data from the Addiction System for Information and Service Tracking (ASIST) database collected from fiscal year (FY) 2015 to 2022 (April 1, 2015, to March 31, 2022) by Alberta Health Services (AHS). ASIST includes data on substance use disorder and behavioural addiction of concern, demographic variables, admission and discharge dates, transition to residential services, and facility information. Our final client-level dataset used for analysis consisted of 20,020 cases representing 39,952 admissions. We only retained cases that captured data from admission to final status. Due to unknown completion statuses, we excluded 197 admissions (195 clients).

Treatment setting

Our study is based on the five publicly funded residential detoxification facilities with 116 beds. Two facilities in Calgary and Edmonton accounted for nearly 80% of all admissions. They are staffed by a multidisciplinary team that provides 24-h service [49]. An individualized daily treatment plan is developed within 24 h of admission in consultation with the client. Upon admission to detox services, clients were asked two questions regarding their substance use or behaviors: the primary concern and any secondary substances or behaviors, along with various sociodemographic variables. Our analysis focuses solely on the primary concern, excluding secondary substances or behaviours from consideration. It is important to note that most clients reported utilizing detox services for multiple substances or engaging in various behaviours. The post-discharge plan includes a discussion of follow-up plans and treatment recommendations. Clients are discharged either after completing the program or non-completing from the program at their own volition or as mandated. Completing detox services in the province is considered successful when clients have fulfilled their individualized initial or revised intervention plans and

established their follow-up plans. Healthcare providers may initiate discharge before completion or when a client cannot meet program expectations, including exhibiting violence or aggressive behaviour; a client can also initiate discharge at any time for any reason. When non-completion occurs, risk follow-up plans should be discussed as appropriate [49]. We aggregated service terminations by staff and clients as non-completion data.

Measures

Outcome variable

The outcome variable was clients' completion status, which was categorized as completion, non-completion, and a cycle of completion and non-completion.

Completed clients are those who have successfully finished their detox admission within the past seven years. They may have been admitted more than once. On the other hand, non-completed clients are those who did not finish their detox program and may also have been readmitted multiple times. Furthermore, clients who cycle between completion and non-completion have completed some admissions while failing to complete others during the study period from 2015 to 2022.

Independent variables

Independent variables included demographic characteristics (education, marital status, gender, employment, place of residence), program variables (number of admissions, LOS, transition to treatment, facilities utilized, days of discharge, and years of admission (admission during COVID-19 emergency), and substance use disorder and behavioural addictions (primary substances use disorder and addictive behaviour of choice, and its count) (details of these variables were assessed in Table 1).

Statistical methods

Descriptive statistics were used to characterize all clients. Further analyses were conducted on data stratified by completion, non-completion, and a cycle of completion and non-completion. We used chi-square tests for categorical variables and the Kruskal–Wallis test for non-normally distributed continuous variables. We also calculated effect size (Cramer's V, and Epsilon square (ϵ^2)). Multivariate multinomial logistic regression analysis was used since the outcome variable was trichotomous. All demographics, program-level factors, and primary concerns of substance use disorder and behavioural addiction were considered for inclusion in the analysis to identify correlates of treatment outcomes. There was no evidence of multicollinearity as all variance inflation factor values were <5 . Data were analyzed using SPSS version 29.

Table 1 Client characteristics by completion status

Variable	Entire Sample 20,020	Completion (11,170, 55.8%)	Non-Completion (5106, 25.5%)	Cycle between completion and non- completion (3744, 18.7%)	Chi-Square/ Kruskal- Wallis	Effect Size
Single Vs Poly-substance use disorder and behavioural addiction						
Single	5618(28.2%)	14,296(71.8%)	1430(25.5%)	378(6.7%)	810.8***	S
Poly	14,296(71.8%)	7292(51%)	3639(25.5%)	3365(23.5%)		
Primary Substance use and behavioural addictions ^a						
Alcohol						
Yes	13,605(68.3%)	8098(59.5%)	2862(21%)	2645(19.4%)	448.5***	S
No	6309(31.7%)	3004(47.6%)	2207(35%)	1098(17.4%)		
Androgen						
Yes	355(1.8%)	157(44.2%)	63(17.7%)	135(38%)	88.2***	S
No	19,559(98.2%)	10,945(56%)	5006(25.6%)	3608(18.4%)		
Amphetamine						
Yes	1096(5.5%)	548(50%)	330(30.1%)	218(19.9%)	17.2***	N
No	18,818(94.5%)	10,554(56.1%)	4739(25.2%)	3525(18.7%)		
Antidepressant						
Yes	574(2.9%)	327(57%)	165(28.7%)	82(14.3%)	9.1*	N
No	19,340(97.1)	10,775(55.7%)	4904(25.4%)	3661(18.9%)		
Barbiturates						
Yes	1304(6.6%)	520(39.9%)	290(22.2)	494(37.9%)	339.2***	S
No	18,610(93.5%)	10,582(56.9%)	4779(25.7%)	3249(17.5%)		
Cocaine						
Yes	4980(25%)	2816(56.5%)	1280(25.7%)	884(17.8%)	4.8	
No	14,934(75%)	8286(55.5%)	3789(25.4%)	2859(19.1%)		
Crystal meth						
Yes	7012(35.2%)	3246(46.3%)	2123(30.3%)	1643(23.4%)	396.2***	S
No	12,902(64.8%)	7856(60.9%)	2946(22.8%)	2100(16.3%)		
Gambling						
Yes	2530(12.7%)	1343(53.1%)	715(28.3%)	472(18.7%)	12.7**	N
No	17,384(87.3%)	9759(56.1%)	4354(25%)	3271(18.8%)		
Inhalant						
Yes	362(1.8%)	189(52.2%)	115(31.8%)	58(16%)	8.1*	S
No	19,552(98.2%)	10,913(55.8%)	4954(25.3%)	3685(18.8%)		
Marijuana						
Yes	2673(13.4)	1511(56.5%)	736(27.5%)	426(15.9%)	19.0***	N
No	17,241(86.6%)	9591(55.6%)	4333(25.1%)	3317(19.2%)		
Opiates ^a						
Yes	6502(32.7%)	2746(42.2%)	2223(34.2%)	1533(23.6%)	723.2***	S
No	13,412(67.4%)	8356(62.3%)	2846(21.2%)	2210(16.5%)		
Other Addiction						
Yes	252(1.3%)	115(45.6%)	80(31.7%)	57(22.6%)	10.7**	N
No	19,662(98.7%)	10,987(55.9%)	4989(25.4%)	3686(18.7%)		
Psychedelics						
Yes	420(2.1%)	224(53.3%)	135(32.1%)	61(14.5%)	12.2**	N
No	19,494(97.9%)	10,878(55.8%)	4934(25.3%)	3682(18.9%)		
Tobacco						
Yes	7435(37.3%)	3948(53.1%)	1985(26.7%)	1502(20.2%)	36.6***	N
No	12,479(62.7%)	7154(57.35)	3084(24.7%)	2241(18%)		

Table 1 (continued)

Variable	Entire Sample 20,020	Completion (11,170, 55.8%)	Non-Completion (5106, 25.5%)	Cycle between completion and non- completion (3744, 18.7%)	Chi-Square/ Kruskal- Wallis	Effect Size
Tranquillizers						
Yes	775(3.9%)	371(47.9%)	262(33.8%)	142(18.3%)	31.2***	N
No	19,139(96.1%)	10,731(56.1%)	4807(25.1%)	3601(18.8%)		
Educational level						
Less than High School	916(4.6%)	454(49.6%)	281(30.7%)	181(19.8%)	133.1***	S
High school	4769(23.8%)	7725(53.9%)	3835(26.8%)	2775(19.4%)		
Post-secondary	14,335(71.6%)	2991(62.7%)	990(20.8%)	788(16.5%)		
Employment						
Employed	6852(34.2%)	4200(61.3%)	1508(22%)	1144(16.7%)	382.4***	S
Unemployed	12,797(63.9%)	6810(53.2%)	3572(27.9%)	2415(18.9%)		
Unstable employment	371(1.9%)	160(43.1%)	26(7%)	185(49.9%)		
Gender						
Female	7153(35.7%)	3753(52.5%)	2039 (28.5%)	1361(19%)	62.0***	N
Male	12,867(64.3%)	7417(57.6%)	3067(23.8%)	1361(19%)		
Marital status						
Divorce, Separated, and Wid- owed	2976(14.9%)	1862(62.6%)	616(20.7%)	498(16.7%)	354.9***	S
Married	4722(23.6%)	2869(60.8%)	1136(24.1%)	717(15.2%)		
Single	12,038(60.1%)	6320(52.5%)	3330(27.7%)	2388(19.8%)		
Unstable marriage	284(1.4%)	119(41.9%)	24(8.5%)	141(49.6%)		
COVID ¹						
Before COVID	5099(48.1%)	2858(56.1%)	1156(22.7%)	1085(21.3%)	1465.7***	L
Within COVID	4023(38.0%)	2184(54.3%)	1178(29.3%)	661(16.4%)		
Both	1475(13.9%)	395(26.8%)	124(8.4%)	956(64.8%)		
Admission						
2015–2018	10,278(51.3%)	6195(60.3%)	2798(27.2%)	1285(12.5%)	3479.4***	L
2019–2022	7050(35.2%)	4101(58.2%)	2095(29.7%)	854(12.1%)		
Both	2692(13.5%)	874(32.5%)	213(7.9%)	1605(59.6%)		
Facilities						
Facility 1	280(1.4%)	193(68.9%)	64(22.9%)	23(8.2%)	1746.0***	M
Facility 2	645(3.2%)	353(54.7%)	199(30.9%)	93(14.4%)		
Facility 3	2921(14.6%)	1881(64.4%)	618(21.2%)	422(14.4%)		
Facility 4	7259(36.3%)	3684(50.8%)	2440(33.6%)	1135(15.6%)		
Facility 5	7878(39.4%)	4764(60.5%)	1685(21.4%)	1429(18.1%)		
Multiple facilities (> = 2)	1037(5.2%)	295(28.4%)	100(9.6%)	642(61.9%)		
Discharge Day						
Saturday and Sunday	3390(16.9%)	1856(54.7%)	1293(38.1%)	241(7.1%)	822.8***	S
Monday to Friday	15,253(76.2%)	8738(57.3%)	3528(23.1%)	2987(19.6%)		
Mix of both	1377(6.9%)	576(41.8%)	285(20.7%)	516(37.5%)		
Urban–Rural						
Urban	16,867(84.3%)	9222(54.7%)	4442(26.3%)	3203(19%)	550.1***	S
Rural	2788(13.9%)	1825(65.5%)	640(23%)	323(11.6%)		
Migration between urban and rural	365(1.8%)	123(33.7%)	24(6.6%)	218(59.7%)		
Transition to treatment						
Detoxification + Treatment	4869(24.3%)	3078(63.2%)	418(8.6%)	1373(28.2%)	1096.0***	M
Detoxification alone	15,151(75.7%)	8092(53.4%)	4688(30.9%)	2371(15.6%)		

Table 1 (continued)

Variable	Entire Sample 20,020	Completion (11,170, 55.8%)	Non-Completion (5106, 25.5%)	Cycle between completion and non- completion (3744, 18.7%)	Chi-Square/ Kruskal- Wallis	Effect Size
Alcohol Vs Opiates						
Alcohol	10,984(55.2%)	6921(63%)	2144(19.5%)	1919(17.5%)	954.4***	M
Opiates	3881(19.5%)	1569(40.4%)	1505(38.8%)	807(20.8%)		
Alcohol and Opiates	2621(13.2%)	1177(44.9%)	718(27.4%)	726(27.7%)		
Neither Alcohol nor Opiates	2428(12.2%)	1435(59.1%)	702(28.9%)	291(12%)		
Length of Stay (LOS)- # of days						
Mean rank		12,430.3	4755.5	9957.7	6243.1***	S
Count of admission						
Mean rank		8650.3	7844.8	17,022.2	9146.4***	RS
Age ²						
Mean rank		10,779.9	8726.3	9441.4	486.6***	W

*** $p < 0.001$, $p < 0.01$ **, $p < 0.05$ Cramér's V N negligible, S small, M Medium, L Large

Epsilon Square W Weak, RS Relatively Strong, S Strong

¹ The province of Alberta had a COVID-19 emergency declared between March 17, 2020 and December 14, 2021. The total number of days was 637. This is compared with the same number of days (from June 19, 2018, to March 16, 2020) before the COVID-19 emergency was declared

² A total of 11 individuals, all reported to be 17 years old, were excluded

^a Missing count of 106

^a Include codeine, heroin, morphine, methadone, Tylenol 1, 2, 3, & 4, Percodan, Percocet, Demerol, Darvon, etc.

Missing data management

We used multiple imputations (MI) that are well-suited for any missing pattern [50] when more than 5% of data points are missing [51], yielding more accurate estimates that resulted in a better complete dataset than complete case analysis (listwise and pairwise deletion) and single imputation case techniques [52, 53]. Our choice of MI is consistent with the nature of our data, where there is uncertainty about the causes of missing data [52]. We used a fully conditional specification MI approach that has proven to produce reliable results [54] under the missing at-random assumption. The MI analysis consists of three distinct phases: the imputation phase, the analysis phase, and the pooling phase [50]. Logistic regression was the model used to impute the data. Several factors, including education, employment, gender, marital status, date of admission, date of discharge, facility zone, facility name, and service end reason, were used to predict missing data points. The imputed data was generated based on five MI data sets to provide a final comprehensive data set. We only imputed independent variables of education, employment, gender, marital status, urban/rural, primary substance use and behavioural addictions, with a missing percentage range of 2 to 32%. These input data were collected at the admission level and structured into a horizontal client-level data format. The proportions of

imputed values are generally consistent with the original values.

Results

This study included 20,020 unique clients who utilized one of Alberta's five residential detoxification services and were admitted 39,952 times, with admissions between 1 and 64. Of these 20,020 clients, 55.8% (11,170) were discharged after completion, 25.5% (5,106) were non-completed, and 18.7% (3,744) cycled between completion and non-completion across all admissions. The average number of admissions per client was 2, while the mean LOS was 4.5 days. Higher rates of non-completion were observed among females (29%) than males (24%); sub-high school clients (31%) than post-secondary education (21%); and single (not married) (28%) than married (24%). The median age of the study sample was 35.3 years. Most clients were male (64.3%), single (60.1%), and unemployed (63.9%). The most frequent substance use disorder and behavioural addictions taking into consideration all substance use disorders and behavioural addictions, were alcohol (27.3%), tobacco (14.9%), crystal meth (14.1%), and opiates (13.0%). Most (71.8%) clients were poly-substance use and behavioural addictions (more than one substance use disorder and behavioural addiction). On average, non-completers were younger than those who completed (35 vs. 39 years). During the

study period, among the clients who did not complete the program, 85.9% ($n=4386$) left voluntarily, while the detox staff discharged 10.4% ($n=533$), and 3.7% ($n=187$) were discharged alternatively, either by clients or detox staff. Table 1 summarizes the results of bivariate analyses.

Results of multivariate analysis

Variables remaining in the final multinomial regression model are presented in Table 2. Our model accurately predicted membership of the completion groups 87.8% of the time, non-completion 69.4%, and the group that cycled between completion and non-completion 56%, resulting in an overall predictive accuracy of 77.1%. The model explained 63.5% of the variance in treatment outcomes based on the Nagelkerke R^2 .

Clients primary substance use disorder and behavioural addiction

When adjusting for the other correlates in the model, alcohol (OR (Odds Ratio)=0.73, $p<0.001$), cocaine (OR=0.89, $p<0.05$), and marijuana (OR=0.78, $p<0.001$) users were less likely to be non-completed versus completion of detoxification. On the contrary, users of amphetamines (OR=1.40, $p<0.01$), barbiturates (OR=1.70, $p<0.001$), crystal meth (OR=1.70, $p<0.001$), opiates (OR=2.78, $p<0.001$), and tranquilizers (OR=1.71, $p<0.001$) were more likely to be non-completed versus completion. In addition, clients who used mono (OR=0.86, $p<0.05$) versus poly-substance use disorder and behavioural addiction had lower odds of non-completion.

Client demographics

Clients who had completed post-secondary education (OR=0.79, $p<0.001$) were less likely to be discharged early than those in high school. Moreover, clients who were employed (OR=0.76, $p<0.001$) and had unstable jobs (OR=0.73, $p<0.01$) compared to the unemployed were less likely to be non-completed versus completed. Females (OR=1.19, $p<0.001$) versus males had higher odds of non-completion versus completion. Married (OR=0.87, $p<0.05$) compared to single clients had lower odds of non-completion. Clients who were residents of urban (OR=1.28, $p<0.001$) compared to rural areas were more likely not to complete versus complete.

Detox episode information

An increase in the count of admissions to detoxification services (OR=0.77, $p<0.001$) and an increase in the LOS (OR=0.39, $p<0.001$) were associated with

lower odds of non-completion versus completion. Clients admitted between FY 2015–18 (OR=0.76, $p<0.001$) compared to those admitted between FY 2019–22 were less likely not to complete detoxification services. Moreover, those discharged on Saturday and Sunday (OR=1.41, $p<0.001$) versus Monday to Friday had higher odds of non-completion versus completion. Clients who utilized detoxification as a standalone service compared to those who transitioned to residential treatment had higher odds of non-completion (OR=2.45, $p<0.001$). Clients who were admitted into Facility 2 (OR=22.65, $p<0.001$), Facility 4 (OR=3.56, $p<0.001$), and those who utilized two or more facilities (OR=2.78, $p<0.001$) compared to Facility 5 had higher odds of non-completion versus completion.

Client substance use disorder and behavioural addiction

Clients who had higher odds of cycling between completion and non-completion included those who used: barbiturates (OR=1.37, $p<0.05$), crystal meth (OR=1.69, $p<0.001$), opiates (OR=2.35, $p<0.001$), other addiction (OR=1.64, $p<0.05$), tobacco (OR=1.17, $p<0.01$), and tranquilizers (OR=1.31, $p<0.05$). Conversely, those who used psychedelics (OR=0.67, $p<0.05$) were less likely to cycle between completion and non-completion versus completion. Those who used single compared to poly-substance use disorder and behavioural addiction had lower odds (OR=0.73, $p<0.001$) of cycling between completion and non-completion.

Clients who cycled between completion and non-completion

Clients who completed post-secondary education (OR=0.81, $p<0.001$) compared to those in high school were less likely to cycle between completion and non-completion. Females (OR=1.21, $p<0.001$) versus males had higher odds of being in cycles of completion and non-completion versus completion. Moreover, clients who were married (OR=0.88, $p<0.05$) were less likely to cycle between completion and non-completion. Furthermore, clients who resided in urban areas (OR=1.40, $p<0.001$) compared to rural residents were more likely to cycle between completion and non-completion versus completion.

An increase in the number of admissions to detoxification services (OR=2.47, $p<0.001$) was associated with increased odds of cycling between completion and non-completion versus completion. On the other hand, an increase in the LOS (OR=0.73, $p<0.001$) decreased the odds of a cycle of completion and

Table 2 Results of logistic regression: Non-completion and clients cycling between completion and non-completion

Variable	Non-Completion	95% Confidence Interval		Cycle between completion and non-completion	95% Confidence Interval	
	Exp(B)	Lower Bound	Upper Bound	Exp(B)	Lower Bound	Upper Bound
Count of admission	0.77***	0.72	0.83	2.47***	2.36	2.58
Average LOS	0.39***	0.38	0.40	0.73***	0.71	0.75
Primary Substance use and behavioural addictions						
Opiates (ref=No)	2.78***	2.49	3.09	2.35***	2.08	2.65
Tranquilizer (ref=No)	1.71***	1.35	2.15	1.31*	1.01	1.69
Barbiturates (ref=No)	1.70***	1.38	2.10	1.37**	1.13	1.66
Crystal meth (ref=No)	1.70***	1.52	1.90	1.69***	1.50	1.91
Amphetamines (ref=No)	1.40**	1.13	1.73	1.23	0.98	1.53
Cocaine (ref=No)	0.89*	0.80	0.99	1.01	0.90	1.14
Marijuana (ref=No)	0.78***	0.68	0.89	0.88	0.76	1.03
Alcohol (ref=No)	0.73***	0.65	0.81	1.10	0.97	1.25
Androgen (ref=No)	0.81	0.52	1.27	0.92	0.63	1.35
Antidepressant (ref=No)	0.97	0.72	1.32	0.78	0.56	1.08
Gambling (ref=No)	0.11	0.97	1.33	1.02	0.86	1.21
Inhalant (ref=No)	0.44	0.81	1.62	1.03	0.71	1.50
Other addiction (ref=No)	1.37	0.92	2.04	1.64*	1.10	2.44
Psychedelics (ref=No)	1.10	0.75	1.42	0.67*	0.46	0.97
Tobacco (ref=No)	0.99	0.90	1.11	1.17**	1.04	1.31
Educational levels						
High school (ref)						
Less than high school	1.09	0.89	1.34	1.11	0.88	1.41
Post Secondary	0.79***	0.71	0.88	0.81***	0.71	0.91
Detoxification Only (ref=detoxification + residential treatment)						
Detoxification alone	2.45***	2.14	2.80	1.35***	1.20	1.51
Facilities Utilized (ref= Facility 5)						
Facility 1	0.87	0.66	1.64	0.76	0.45	1.30
Facility 2	22.65***	16.52	31.05	6.16***	4.43	8.56
Facility 3	1.15	1.00	1.34	1.07	0.90	1.27
Facility 4	3.56***	3.20	3.96	1.77***	1.56	2.01
Combination of two or more	2.78***	2.09	3.74	2.71***	2.23	3.30
Discharge Days (ref=Monday to Friday)						
Saturday and Sunday	1.41***	1.27	1.57	0.79**	0.67	0.94
Both	1.30**	1.07	1.56	2.25***	1.94	2.61
Gender (ref= Male)						
Female	1.19***	1.09	1.31	1.21***	1.09	1.34
Admission Year (ref= 2019 to 2022)						
2015 to 2018	0.76***	0.69	0.84	0.88*	0.78	0.99
Both	0.73**	0.59	0.90	1.32***	1.13	1.53
Employment (ref= Unemployed)						
Employed	0.76***	0.67	0.81	0.93	0.83	1.04
Unstable employment	0.73**	0.30	0.82	1.22	0.91	1.63
Marital status (ref= Single)						
Divorce, Separated, and Widowed	0.91	0.80	1.04	0.92	0.79	1.07
Married	0.87*	0.78	0.97	0.88*	0.77	1.00
Unstable marriage	1.01	0.59	1.74	1.29	0.91	1.82
Mono vs multiple substance use disorder and behavioural addiction						
Mono substance (ref= Polysubstance)	0.86*	0.76	0.98	0.73***	0.71	0.75
Place of residence (ref= rural)						
Urban	1.28***	1.13	1.46	1.40***	1.19	1.65
Migrated between urban and rural	0.93	0.55	1.58	1.40	1.00	1.97

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

non-completion versus completion. Clients who were admitted in Facility 2 ($OR=6.16$, $p<0.001$), Facility 4 ($OR=1.77$, $p<0.001$), and those who utilized two or more facilities ($OR=2.71$, $p<0.001$) had higher odds of cycling between completion and non-completion than completion. Clients admitted into detoxification facilities between 2015 and 2018 ($OR=0.88$, $p<0.05$) compared to those admitted between 2019 and 2022 were less likely to cycle between completion and non-completion. Those discharged on Saturday and Sunday ($OR=0.79$, $p<0.01$) compared to those discharged on Monday to Friday had lower odds of cycling between completion and non-completion. Moreover, clients who utilized detoxification as a standalone service ($OR=1.35$, $p<0.001$) compared to those who transitioned to residential treatment have higher odds of cycling between completion and non-completion versus completion.

Discussion

This study provides critical insights into the complexity of recovery trajectories among clients who utilized detoxification services, the social determinants associated with detoxification completion, as well as programmatic and contextual factors that played a role in detoxification completion.

Complexity of recovery trajectories

With a majority of clients completing detoxification (55.8%), a substantial portion not completing (25.5%), and a notable 18.7% cycling between the two outcomes, the findings underscore the complexity of recovery trajectories and the pressing need to tailor interventions to better support clients at various stages of the detoxification process.

The completion and non-completion rates in this study are consistent with those reported in over 20 previous studies, which found wide ranges for both completion (37–94%) and non-completion (5–63%) [6, 17, 21, 24–27, 29–31, 37–39, 41, 47, 55–59]. However, unlike previous studies that relied on a binary classification, this study introduces a trichotomous categorization, offering a more nuanced view of client experiences. A sensitivity analysis using a dichotomous lens aligned with prior research, placing the completion rate at 69% and non-completion at 31%, further validates the robustness of these findings.

The identification of a distinct group—those who cycle between completion and non-completion—adds an important dimension to our understanding of detoxification. This pattern reflects the chronic and relapsing nature of addiction, in which individuals often require multiple detox and treatment episodes over extended

periods [9, 60, 61]. Prior research indicates that it can take a median of nine years from first treatment to sustained recovery or 27 years from first use to cessation [32], underscoring the importance of longitudinal support and engagement strategies.

Substance type emerged as a key factor influencing completion outcomes. Clients detoxifying from alcohol, cocaine, and marijuana were more likely to complete treatment, whereas those withdrawing from opiates, crystal meth, amphetamines, barbiturates, and tranquilizers were significantly more likely to not complete or cycle through detoxification attempts. These findings align with prior literature, particularly regarding alcohol's higher odds of completion [6, 24, 27, 37, 39] and lower odds of completion among individuals struggling with opiates [6, 35–37, 39, 62] and tranquilizers [18]. Interestingly, while the use of psychedelics was associated with lower odds of cycling between completion and non-completion, tobacco users had higher odds of cycling between completion and non-completion, a finding not reported in previous research.

The high rate of non-completion among clients detoxifying from opiates is particularly concerning, given Alberta's rising opioid overdose crisis [63, 64]. The elevated risk of overdose following detox-related tolerance reduction, especially in the absence of follow-up care or naloxone distribution [65–67], highlights a critical point of intervention. Conversely, the life-threatening nature of alcohol withdrawal [5] may motivate clients to remain in detox until completion, explaining the comparatively higher completion rates.

Furthermore, clients with mono-substance use or behavioural addiction were less likely to discontinue detoxification, consistent with two previous studies [8, 55] or cycles between completion and non-completion attempts, suggesting that poly-substance use presents greater challenges for stabilization and completion. These findings emphasize the need for differentiated withdrawal management protocols based not only on the substance of concern but also on the complexity of use patterns.

Taken together, these results underscore the importance of adopting a more individualized and data-informed approach to detox service delivery. Addressing the distinct challenges faced by clients who cycle between completion and non-completion through treatment or who are at high risk of non-completion—particularly those with opioid use disorders or multiple substance dependencies—may improve outcomes and reduce systemic inefficiencies. Future research should further investigate the factors contributing to cycling patterns and explore interventions that can better support sustained engagement in the recovery process.

Social determinants in detoxification

This study adds important evidence to the literature by examining how key social determinants of health—education, employment, gender, marital status, and geographic location—influence detoxification completion outcomes. Our findings underscore that these broader contextual and socio-economic factors substantially shape client engagement and success in residential detoxification programs.

Clients with higher educational attainment, particularly those who had completed post-secondary education, were significantly less likely to discontinue detoxification than those who had not completed high school. This pattern is consistent with prior studies [22, 30, 55] and highlights education as a potential protective factor, possibly linked to greater health literacy, problem-solving skills, and access to resources.

Education also appears to intersect with employment status, as those with post-secondary education had the highest employment rates. Employment status similarly emerged as a strong correlate of detoxification completion. Clients who were employed or experiencing unstable employment were less likely to discontinue detox compared to those who were unemployed. While previous studies have established the positive influence of employment on treatment outcomes [8, 30], our study is among the first to identify that even unstable employment may confer some benefit in reducing non-completion risk. This suggests that engagement with the workforce may foster structure, motivation, or access to support systems that facilitate treatment completion, even in a limited or inconsistent capacity.

Gender differences in detox completion also warrant attention. Female clients were less likely to complete detox, a finding that aligns with Li et al. [36] but diverges from the conclusions of Sofin et al. [30]. One potential explanation is that the caregiving burden often shouldered by women, particularly those who are primary caregivers for children [68], may create additional logistical and emotional barriers to completing residential treatment. However, further investigation is needed to clarify the gendered dynamics influencing detox outcomes.

Marital status was another significant correlate of completion. Married clients were more likely to complete detox than those who were single, supporting prior findings [34, 69, 70]. These results suggest that spousal or partner support may serve as a motivational or practical resource during the detoxification process. While this aligns with the broader literature on the role of couples in enhancing treatment outcomes [71], it contrasts with earlier studies that either found no relationship [43] or even higher dropout rates among married individuals [18]. These mixed findings suggest a more nuanced

understanding of relationship dynamics that could support or strain detoxification completion.

Finally, geographic location influenced detoxification completion, with urban clients experiencing higher odds of non-completion compared to those from rural areas. While this may reflect stronger community ties or support networks in rural settings [72], it contradicts previous research that found no significant relationship between urban–rural residency and completion outcomes [43]. These discrepancies highlight the importance of considering local context and the availability of formal and informal supports when interpreting geographic effects on health behaviours.

Collectively, these findings affirm the critical influence of social determinants on detoxification outcomes. Integrating this knowledge into clinical practice and policy design may improve retention and recovery outcomes by addressing structural and interpersonal barriers that hinder completion. Future research should explore targeted interventions—such as child care support for women, employment assistance, and relationship-based counselling—that address these determinants and support clients at greater risk of non-completion.

Programmatic and contextual factors

This study emphasizes the significance of programmatic and contextual factors in influencing detoxification outcomes, including length of stay, transition to treatment, the impacts of COVID-19 and policy changes, programming and staffing differences, and facility variations.

Clients who completed detox had significantly longer lengths of stay (LOS), consistent with previous findings [1, 18, 21, 25, 26, 31, 42]. Longer LOS enables greater engagement with treatment, more sober days [47], and improved transition into residential care—the primary goal of detoxification [20, 73–75]. Clients who cycled between completion and non-completion resembled non-completers in LOS and facility utilization but with more frequent admissions. This group reflects the chronic, relapsing nature of addiction and underscores the need for flexible, patient-centred care strategies.

Clients who did not complete treatment had fewer admissions, suggesting early exits may discourage future attempts. While multiple admissions are often seen negatively, our findings align with prior research [2], indicating they can increase the odds of eventual completion. This underscores the value of low-barrier re-entry for individuals in the early stages of recovery.

Transition into residential treatment was also lower among non-completers, supporting earlier studies [2, 20, 26, 47]. Some clients may use detox as a harm-reduction measure [11] or believe detox alone is sufficient [13].

Regardless of intention, promoting completion remains vital for long-term recovery outcomes.

A concerning pattern emerged among clients admitted between 2019–2022, who had higher non-completion rates than those admitted earlier. Potential explanations include service disruptions, staff shortages during the COVID-19 pandemic [76–78], and policy changes under a new provincial government. These findings point to the need for resilient treatment systems during large-scale disruptions. Weekend discharges were also associated with higher non-completion, consistent with previous research [6, 15, 24, 36], possibly due to reduced staffing or competing commitments. Enhancing weekend programming and support may mitigate this risk.

Facility-level differences further influenced outcomes. Clients at Facility 2 and Facility 4, or those attending multiple facilities, were less likely to complete detox. Higher proportions of urban clients and early staff-initiated discharges may contribute to these trends. Facility 2's higher female client population may also explain some of the disparity, echoing earlier gender-based findings in this study. The differentiating factors between facilities that influenced client completion require future observational studies and interviews to delineate.

We have observed a recurring trend among clients who alternate between completing and not completing their treatment, as well as those who did not complete their treatment, regarding their length of stay, facilities used, transition to residential treatment, place of residence, and year of admission (2015 to 2018). Conversely, as the frequency of admissions increases, the likelihood of cycling between completion and non-completion also rises. This suggests that these clients may have a higher rate of admissions overall.

Together, these findings underscore the value of addressing structural and programmatic variables—such as LOS, admission timing, staffing, and facility practices—to improve completion rates and strengthen recovery outcomes.

Overall implications

Detoxification is a vital gateway to residential treatment. Our findings show that completion significantly increases the odds of treatment entry, making it a key intervention point. With over 25% of clients not completing detox—and most leaving voluntarily—targeted efforts to understand client needs and streamline protocols are essential.

Expanding treatment options post-detox is critical. Programs and interventions to enhance individual motivation and marital and family support are also crucial. Employment support, family relief options, and responses to gender-based barriers, e.g., caregiving, gender-based programming, and inquiry about intimate partner violence

[79], can improve outcomes, especially for women. Additionally, tailoring withdrawal protocols and support to specific substances—particularly for crystal meth, tranquilizers, and poly-substance use—may enhance completion and reduce overdose risks, especially with opiates. Revisiting the opiate protocol and developing new guidelines for poly-substance users (72% of the sample) are recommended for more effective withdrawal management.

Strengths and limitations

This study has several strengths, including a large, province-wide sample, a broad range of correlates, and the inclusion of clients who cycled between completion and non-completion—highlighting the complexity of addiction and recovery. Unlike studies relying on self-reports, our use of administrative, longitudinal data from routine care provides a picture of real-world detoxification patterns [80, 81]. The reliance on administrative data also has its limitations. Such data do not provide a nuanced understanding of the characteristics of each facility and the client's experience of their detoxification program.

Several other limitations should be noted. Clients discharged on the same day or who died during care were excluded, potentially underestimating non-completion rates. Further, the findings reflect only public provincial detox services and exclude community-based or private facilities, limiting generalizability. The data do not capture those who needed but did not access services, nor do they include client perspectives, which could add valuable context. The time series design may not fully account for historical events, and examining many variables increases the risk of a Type I error. While differences across facilities were observed, we could not identify the underlying causes. Future studies—particularly experimental studies comparing sites or qualitative research using observation and interviews—are needed to characterize the differences that make a difference and improve understanding across diverse service settings. Additionally, future research could investigate the effects of how independent variables interact with one another on completion.

Conclusion

The findings of this study reveal novel findings about the characteristics of clients who completed detoxification, were non-completed, or cycled between completion and non-completion from residential withdrawal management services. These findings can be utilized to develop targeted interventions for clients at risk of non-completion. Our study highlighted the challenges and non-linearity of the recovery process, where clients experience a completion cycle, get readmitted and then non-completed detoxification services several times. The 19% who cycled between completion

and non-completion could have been misclassified in previous studies using a binary outcome. Our findings underscore the need to address the social determinants of health and program outcomes to improve the completion of detox. Further research comparing treatment outcomes between facilities/programs is needed.

Abbreviations

LOS	Length of Stay in number of days
ASIST	The Addiction System for Information and Service Tracking database
FY	Fiscal Year
MI	Multiple Imputation
OR	Odds Ratio
AHS	Alberta Health Services
NDP	The New Democratic Party

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Authors' contributions

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Data availability

The datasets generated and analyzed can not be shared due to the restrictions of the dataset owner.

Declarations

Ethics approval and consent to participate

This study was approved by the University of Alberta Research Ethics Board (REB) protocol No Pro00108773.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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