Trends in Treatment for Cannabis Problems in Ontario - Fiscal Years 2010/11 to 2015/16: A Panel Data Study

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Declarations of Authors Competing Interests
All authors declare no competing interests.

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ABSTRACT

Background
Trends in clients receiving treatment for cannabis problems in Ontario were examined. The addiction severity of these clients was also characterized.

Methods
This was a panel design study using data from the Drug and Alcohol Treatment Information System, the reporting system for publicly funded addiction treatment in Ontario. All clients receiving treatment for cannabis problems between April 01, 2010 and March 31, 2016 were included. Two groups of clients were formed: cannabis as the only problem substance (CO) and cannabis plus other problem substances (CP). Numbers of clients among these two groups by new admissions and total caseload (new admissions plus carryovers) were generated for each fiscal year. Addiction severity was characterized by cannabis use frequency. Trends were assessed through regression and chi-square analyses.

Results
New admissions among the CO group decreased from 2,954 clients (95% CI: 2,848-3,062) in 2010/11 to 2,342 clients (95% CI: 2,248–2,439) in 2015/16, representing a percentage decrease of 21% (linear trend test p-value: 0.012). Similar trends were observed among the total caseload of the CO group. New admissions among the CP group were stable, but the total caseload increased by 8% from 20,139 clients (95% CI: 19,862 – 20,419) in 2011/12 to 21,816 clients (95% CI: 21,527–22,107) in 2015/16 (linear trend test p-value: 0.005). Proportions of daily cannabis use frequency increased among all treatment groups (Percentage Change 7–31%).

Interpretation
The decreases in treatment utilization and increases in addiction severity may be suggestive of reductions in clinically unnecessary treatments of cannabis use disorders.

KEYWORDS
Canada – cannabis – cannabis use disorders – health services

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1. INTRODUCTION

Cannabis is the most commonly used illicit substance in Canada, with a 12-month prevalence nearing 12% among those 15 years and older.(1) About one in ten cannabis users develop cannabis use disorders,(2) a state characterized by problematic use despite clinically significant impairment or distress.(3) Cannabis use disorders are the primary source of the cannabis-attributable burden of disease in Canada, constituting more than 70% of the disability-adjusted life years.(4, 5)

Normalization of cannabis use has continued in Canada,(6) a process whereby drug use becomes less stigmatized and more accepted as normative behavior.(7) Legislation increasing access to medicinal cannabis was introduced in 2013.(8) Under the new legislation, physicians are designated as the gatekeepers, whereas the government has limited itself to supply regulation.(8) As a consequence, more than 2% of the adult Canadian population is expected to self-identify as medicinal cannabis users over the coming years.(8) Furthermore, public opinion towards cannabis control policies has continued to shift away from favoring prohibition,(9) leading the government to commit to legalizing recreational cannabis by 2018. At the same time, the prevalence of 12-month cannabis use has increased from 11% in 2013 to 12% in 2015.(1, 10). This increase in general has been pronounced in Ontario, where prevalence has risen by 67% between 1996 and 2015.(11)

Given these recent developments, examination of trends in cannabis-related harms are of utmost interest. Treatment of cannabis use disorders can be considered an indirect indicator of cannabis use disorders. Most relevant studies on this topic are outdated, as well as based on clinical samples from single agencies, limiting the generalizability of their results.(12-16) However, some evidence from Ontario suggests that after increasing towards the end of the last decade, treatment utilization for cannabis use disorders may be decreasing.(17-19) Although comparable data is not available in Canada, prevalence of almost daily or daily cannabis use has increased between 2002 and 2014 in the United States.(20) As such, the addiction severity of clients receiving treatment for cannabis problems may be increasing.

Using health administrative data from the addiction treatment system in Ontario, trends in clients receiving treatment for cannabis problems were examined between fiscal years 2010/11 and 2015/16. The addiction severity of these clients was also characterized. It was hypothesized that the numbers of clients receiving treatment would decrease over time, but the addiction severity would increase.

2. METHODS

2.1. Study Setting, Design and Data Source

A panel design was operationalized to estimate the numbers of clients receiving treatment for cannabis problems in Ontario from 2010/11 to 2015/16, as well as characterize their addiction severity.

Data were obtained from the Drug and Alcohol Treatment Information System (DATIS), the reporting system for publicly funded addiction treatment in Ontario. As part of this health administrative database, more than 150 agencies are required to submit service utilization data for each fiscal year (April 1st to March 31st), with a participation rate exceeding 95% at the service-level. These agencies deliver a range of referral, outpatient, residential and withdrawal management services. However, private, self-help and pharmacotherapeutic services are not included. The treatment plan is typically a negotiated process between the client and staff. All data are entered electronically by staff and stored centrally at the Centre for Addiction and Mental Health.

2.2. Measures

At the beginning of an admission, clients provide data on a range of self-reported characteristics. Data on up to five, non-ranked problem substances related to the admission are also collected at this time. On their basis, clients were divided into two groups : 1) cannabis as the only problem substance (CO), and 2) cannabis plus other problem substances (CP). These classifications did not necessarily correspond to clinical diagnoses of cannabis use disorders.

Sociodemographic characteristics included age, sex, relationship status, educational attainment, employment status, legal problems and mandated treatment (e.g. by legal system, family). The primary addiction severity measure was cannabis use frequency, an established predictor of cannabis problems.(21) In particular, some evidence indicates that frequent cannabis use correlates with dependence severity.(22) The secondary addiction severity measure was utilization of withdrawal management services.

2.3. Selection Criteria

Admissions that began between 2010/11 and 2015/16 were included. The exclusion criteria consisted of admissions involving 1) family members of clients, 2) non-Ministry of Health and Long-Term Care funded clients, 3) gambling problems services only, 4) missing problem substance data, and 5) non-cannabis problems only.

2.4. Classification Methodology

Admissions were categorized into fiscal years ranging from 2010/11 to 2015/16 based on their start dates. For each fiscal year, the first admission was selected as a new admission, with preference given to CP over CO admissions, if both existed. This decision was made to prevent misclassification, as clients often recognize other substance problems once they begin an interaction with the addiction treatment system. Carryover admissions (i.e. admissions continuing from previous fiscal years) were selected if a client did not begin an admission in the fiscal year. As before, preference was given to CP over CO carryover admissions. For all clients, the most wide-ranging carryover admissions were selected, with representation ensured across all fiscal years where treatment was received. In the event of duplicate carryover admissions, selection for the fiscal year was dependent on the start date of the admissions. On the other hand, length and end date of the admissions guided the selection for the fiscal year when overlapping carryover admissions were encountered.

2.5. Statistical Analyses

Two sets of numbers of clients by fiscal year were generated for both CO and CP groups: new admissions and total caseload (new admissions plus carryovers). The methodology yielded unduplicated numbers of clients for each fiscal year. Exact Poisson confidence intervals were generated for these numbers, with regression analyses utilized for the assessment of linear trends. Thereafter, trends in sociodemographic characteristics were assessed among new admissions through chi-square analyses. Subsequently, trends in cannabis use frequency and utilization rates of withdrawal management services were assessed through chi-square analyses and regression analyses, respectively. Importantly, total caseload estimates for 2010/11 did not include carryover admissions due to the underlying study design. As such, they were not generated and excluded from all trend analyses. All analyses were conducted in SAS Version 9.4 and STATA Version 14.

2.6. Ethics Compliance
Approval to access the data was obtained from the research ethics board at the Centre for Addiction and Mental Health (Protocol Reference # 012/2017). All data analyzed were de-identified and cells of less than five in cross-tabulations were suppressed in the presentation of the results.

3. RESULTS
The data analyzed included 152,984 admissions from 83,621 clients. There were 25,463 admissions that started in 2010/11, 26,413 admissions in 2011/12, 25,399 admissions in 2012/13, 25,623 admissions in 2013/14, 25,258 admissions in 2014/15 and 24,828 admissions in 2015/16.

3.1. Trends in Treatment Utilization
Trends in clients receiving treatment among the CO and CP groups are displayed in Figures 1 and 2, respectively (see also Table S1 in the supplementary appendix for the underlying data).

After increasing between 2010/11 and 2011/12, there were annual decreases thereafter in new admissions among the CO group. During the examined time frame, new admissions decreased overall from 2,954 clients (95% Confidence Interval (CI): 2,848 - 3,062) in 2010/11 to 2,342 clients (95% CI: 2,248 – 2,439) in 2015/16, representing a percentage decrease of 21% (linear trend test p-value: 0.012). Similar decreases were observed among the total caseload of the CO group: 4,188 clients (95% CI: 4,062 – 4,317) in 2011/12 to 3,650 clients (95% CI: 3,533 – 3,770) in 2015/16 (linear trend test p-value = 0.013).

New admissions among the CP group were more or less stable between 2010/11 and 2015/16 (linear trend test p-value: 0.543). However, there were annual increases in the total caseload among the CP group, rising from 20,139 clients (95% CI: 19,862 – 20,419) in 2011/12 to 21,816 clients (95% CI: 21,527 – 22,107) in 2015/16 (linear trend test p-value: 0.005).

3.2. Trends in Sociodemographic Characteristics
Trends in sociodemographic characteristics among new admissions of CO and CP groups between 2010/11 and 2015/16 are presented in Table 1. Among both CO and CP groups,

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proportions decreased of male clients (Percentage Change (Δ) 2 – 4%), less than secondary school education clients (Δ 17 – 19%) and student or re-training clients (Δ 28 – 32%), but proportions increased of non-mandated clients (Δ 12 – 14%). Age decreased overall among both groups, as the proportion of less than 18 year old clients decreased (Δ 27%) among the CO group and proportion of 25 – 44 year old clients increased (Δ 10%) among the CP group. In terms of relationship status, proportions decreased of single clients (Δ 4%) among the CO group and of widowed or divorced clients (Δ 8%) among the CP group. Although the proportion of clients awaiting trial or sentencing increased (Δ 34%) among the CO group, there were decreases in the proportion of probational, paroled or incarcerated clients (Δ 20%) among the CP group.

3.3. Trends in Addiction Severity

Trends in cannabis use frequency among CO and CP groups' new admissions and total caseloads between 2010/11 and 2015/16 are presented in Table 2. There were annual fluctuations in cannabis use frequency among new admissions of the CO group. However, the proportion of daily cannabis use frequency increased overall by 31%, rising from 37% in 2010/11 to 48% in 2015/16. Similar trends were observed in daily cannabis use frequency among the CO group's total caseload (Δ 17%), as well as CP group's new admissions and total caseload (Δ 12% and 7%, respectively).

There were annual decreases in rates of utilization of withdrawal management services for most groups from 2010/11 to 2013/14, but subsequent increases were observed from there onwards (Table S2 in the supplementary appendix). The linear trend test was non-significant for all groups, with the exception of the increase observed among the CO group's new admissions (linear trend test p-value: 0.044).

4. INTERPRETATION

4.1. Summary of Main Results

Through health administrative data obtained from the addiction treatment system in Ontario, it was shown that new admissions and total caseload among the CO group decreased between 2010/11 and 2015/16. On the other hand, new admissions were stable during the examined time frame among the CP group, but the total caseload increased. At the same time, proportions of daily cannabis use, an indicator of addiction severity, increased among both CO and CP group's new admissions and total caseloads.

4.2. Comparisons and Explanations of Findings

Based primarily on new admissions in a fiscal year, health administrative data from the addiction treatment system in Ontario has been analyzed before to obtain insights about treatment of cannabis problems. Urbanoski and colleagues showed that cannabis was reported by 6,219 clients as a primary problem substance and by 14,633 clients as a problem substance in 2000/01.(12) However, the system has undergone considerable changes since then, limiting the comparability with the results of the present study. Rotondi and Rush later demonstrated that reports of cannabis as a problem substance increased from 16,351 clients in 2005/06 to 17,854 in 2009/10.(17) Notably, minor decreases in numbers of clients were observed in their study between 2008/09 and

2009/10.(17) The National Treatment Indicators Reports most recently documented that reports of cannabis as a problem substance decreased from a little over 30% among all admissions in 2012/13 to 20% in 2013/14.(18, 19) Even though a different methodology was used, as the estimates from the National Treatment Indicators Reports did not account for multiple admissions per client, and were relative to the proportions of all admissions,(18, 19) their trends do seem consistent with the results of the present study.

An important consideration concerning the legalization of recreational cannabis in Canada is the impact on cannabis-related harms. It has been particularly difficult to predict the potential impact of this policy reform on treatment for cannabis use disorders.(23) The results of the present study demonstrate that as the normalization of cannabis use continues in Canada, less clients are receiving treatment for cannabis use disorders, but their addiction severity may be increasing. Taken together, these results may be indicative of reductions in clinically unnecessary treatments for cannabis use disorders, such as adolescents forced into treatment by others mainly for cannabis use. This explanation is supported by decreases in proportions of mandated treatments observed among clients. Corroborating this explanation further are observations from the United States, where cannabis use has been increasing, but the rate of cannabis use disorders per user is decreasing.(24) However, alternative explanations cannot be ruled out due to the study design. It is conversely possible that normalization of cannabis use may be affecting the patterns of usage, or leading to more accurate reporting about them due to less perceived stigma. Although both of these phenomena would depict increases in addiction severity, there are differences in the implications, as the former would be suggestive of actual increases in addiction severity and the latter of no changes in addiction severity. This is an important line of investigation that warrants further research.

4.3. Study Strengths and Limitations

There are some notable strengths of the present study that deserve mention. The population-based nature of the data permits generalizability of the results. In addition, trends in new admissions and total caseloads were characterized, with the latter estimated for the first time. There are however some limitations of the present study that should be considered in the interpretation of the results. The data were susceptible to social desirability and recall biases, as they were based on self-reports. Data were also susceptible to misclassification bias, given they were obtained from a health administrative database not intended for research. On a similar note, group formation on the basis of self-reports of substance problems as opposed to diagnoses of substance use disorders may have also resulted in misclassification bias. As well as, it was not possible to determine if receipt of withdrawal management services among the CP group were for cannabis problems or other substance problems. The above described potential effects of social desirability, recall or misclassification biases might have affected the validity of the results reported in the present study. Furthermore, the data did not include private, self-help or pharmacotherapeutic services, resulting in underestimation of treatments received for cannabis problems. All data were ascertained at the beginning of the admissions. As such, it was not possible to account for changes in measures over time, which is particularly relevant to carryover admissions because they were represented across multiple fiscal

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years in analyses of total caseloads (ranging from 22% to 31% of total caseloads in a given fiscal year).

4.4. Conclusions

The impact of recreational cannabis legalization in Canada on treatment for cannabis use disorders needs to be monitored and assessed in the long term. The results of this study represent an important baseline. They indicate decreases in treatment utilization for cannabis problems in Ontario from 2010/11 to 2015/16, but corresponding increases in addiction severity. Together, these results may be suggestive of reductions in clinically unnecessary treatments of cannabis use disorders within the past five years.

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Table 1: Trends in sociodemographic characteristics between 2010/11 and 2015/16 among new admissions of clients receiving treatment for cannabis as the only problem substance and cannabis plus other problem substances

	CO New Admissions					CP New Admissions				
	2010/11		2015/16		P-Value	2010/11		2015/16		P-Value~
	N	%	N	%		N	%	N	%	
Sex					0.039					0.002
Males	2143	72.55	1633	69.97		10782	69.81	10387	68.17	
Females	811	27.45	701	30.03		4663	30.19	4850	31.83	
Age					0.000					0.000
< 18	1344	45.51	779	33.26		2080	13.46	1372	8.98	
18 - 24	861	29.16	743	31.73		4139	26.79	3814	24.96	
25 - 44	580	19.64	656	28.01		7182	46.48	7807	51.10	
> 44	168	5.69	164	7.00		2050	13.27	2286	14.96	
Relationship Status					0.017					0.025
Married	378	12.89	355	15.48		2617	17.05	2527	16.94	
Single	2424	82.65	1816	79.20		10946	71.33	10757	72.10	
Window(er)	7	0.24	8	0.35		86	0.56	110	0.74	
Separated or divorced	124	4.23	114	4.97		1697	11.06	1525	10.22	
Education					0.000					0.000
< Secondary school	2089	71.86	1304	57.98		8254	54.55	6654	45.23	
Completed secondary school	414	14.24	492	21.88		3393	22.42	3638	24.73	
Some post-secondary	228	7.84	225	10.00		1816	12.00	2147	14.60	
Completed post-secondary	176	6.05	228	10.14		1668	11.02	2271	15.44	
Employment Status					0.000					0.000
Full- or part-time	594	20.53	673	29.43		3848	25.27	4265	28.30	
Unemployed	524	18.11	464	20.29		5763	37.84	5725	37.98	
Student/retraining	1488	51.42	845	36.95		2725	17.89	1833	12.16	
Disabled	174	6.01	176	7.70		1687	11.08	2187	14.51	
Not in labor force	114	3.94	129	5.64		1207	7.93	1062	7.05	
Legal Problems					0.000					0.000

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None	1923	68.12	1591	69.72		9532	63.41	10044	66.92	
Awaiting trial or sentencing	235	8.32	255	11.17		1807	12.02	1930	12.86	
Probation, parole or incarcerated	370	13.11	239	10.47		3083	20.51	2476	16.50	
Other	295	10.45	197	8.63		610	4.06	558	3.72	
Treatment Mandate					0.000					0.000
None	1459	51.30	1341	58.28		10436	69.05	11672	77.24	
Legal system	350	12.31	276	11.99		2018	13.35	1665	11.02	
Child welfare authority	137	4.82	95	4.13		663	4.39	464	3.07	
Employee or school authority	337	11.85	230	10.00		625	4.14	336	2.22	
Family	210	7.38	123	5.35		577	3.82	350	2.32	
Other	351	12.34	236	10.26		794	5.25	625	4.14	

Abbreviations: *CO*: cannabis as the only problem substance, *CP*: cannabis plus other problem substances

~P-value obtained from the chi-square test

Table 2: Trends in cannabis use frequency among new admissions and total caseloads^ of clients receiving treatment for cannabis as the only problem substance (CO) and cannabis plus other problem substances (CP) between 2010/11 and 2015/16

	2010/11		2011/12		2012/13		2013/14		2014/15		2015/16		P-Value~
	N	%	N	%	N	%	N	%	N	%	N	%	
CO New Admissions													
Did not use	382	13.79	341	11.75	367	14.19	327	12.74	353	13.76	275	12.26	0.000
1–3 times monthly	284	10.25	307	10.58	260	10.05	301	11.73	281	10.95	197	8.78	
1–2 times weekly	553	19.96	615	21.18	469	18.13	374	14.58	385	15.00	297	13.24	
3–6 times weekly	480	17.32	429	14.78	423	16.35	426	16.60	426	16.60	360	16.05	
Daily	1014	36.59	1156	39.82	1027	39.70	1078	42.01	1072	41.78	1077	48.02	
Binge	58	2.09	55	1.89	41	1.58	60	2.34	49	1.91	37	1.65	
CO Total Caseload													
Did not use	-	-	468	12.03	495	13.31	469	12.71	486	13.12	437	12.58	0.000
1–3 times monthly	-	-	417	10.72	392	10.54	421	11.41	405	10.93	326	9.38	
1–2 times weekly	-	-	760	19.54	640	17.21	543	14.72	556	15.01	466	13.41	
3–6 times weekly	-	-	603	15.50	612	16.46	637	17.26	626	16.90	555	15.97	
Daily	-	-	1572	40.41	1517	40.80	1550	42.01	1568	42.33	1637	47.11	
Binge	-	-	70	1.80	62	1.67	70	1.90	63	1.70	54	1.55	
CP New Admissions													
Did not use	2161	14.35	2163	13.88	2011	13.34	2045	13.21	1925	12.66	1853	12.48	0.000
1–3 times monthly	2134	14.18	2129	13.66	2095	13.90	2135	13.79	2095	13.77	1887	12.71	
1–2 times weekly	2006	13.33	2010	12.90	1935	12.84	1926	12.44	1801	11.84	1790	12.06	
3–6 times weekly	2005	13.32	2102	13.49	2113	14.02	2070	13.37	2055	13.51	1880	12.67	
Daily	6111	40.59	6518	41.83	6268	41.59	6633	42.85	6721	44.19	6775	45.64	
Binge	637	4.23	661	4.24	650	4.31	669	4.32	612	4.02	658	4.43	
CP Total Caseload													
Did not use	-	-	2941	14.99	2857	14.48	2893	14.12	2894	13.79	2911	13.75	0.000
1–3 times monthly	-	-	2689	13.71	2768	14.02	2854	13.93	2894	13.79	2774	13.10	
1–2 times weekly	-	-	2515	12.82	2530	12.82	2562	12.50	2562	12.20	2587	12.22	

3–6 times weekly	-	-	2677	13.64	2783	14.10	2805	13.69	2868	13.66	2756	13.01
Daily	-	-	8028	40.92	8034	40.71	8558	41.77	9006	42.90	9307	43.95
Binge	-	-	770	3.92	765	3.88	817	3.99	769	3.66	841	3.97

Abbreviations: *CO*: cannabis as the only problem substance, *CP*: cannabis plus other problem substances
^ Total caseload estimates were not generated for 2010/11
~ P-value obtained from the chi-square test

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Figure 1: Trends in new admissions and total caseload of clients receiving treatment for cannabis as the only problem substance between 2010/11 – 2015/16
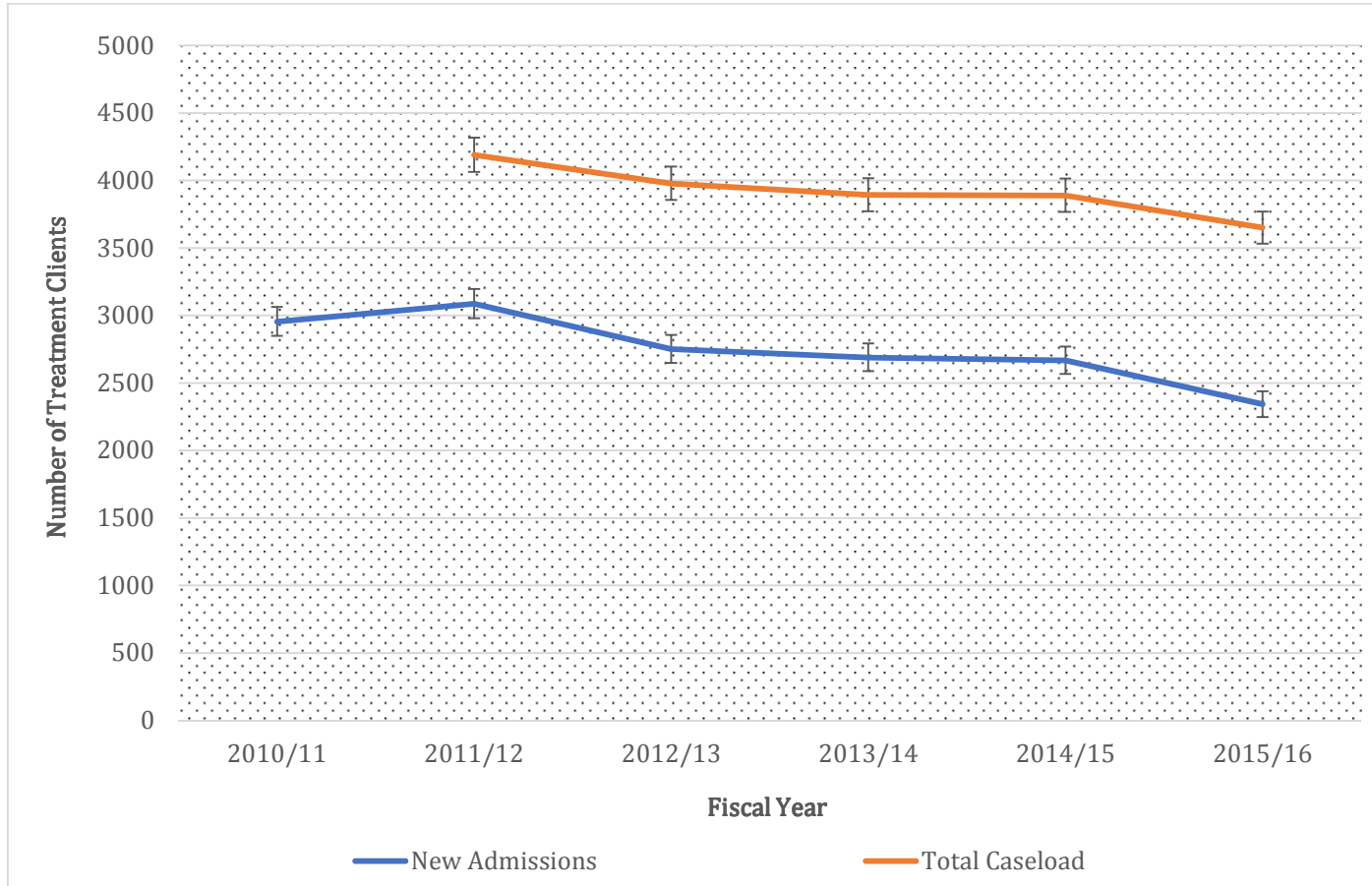
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Figure 2: Trends in new admissions and total caseload of clients receiving treatment for cannabis plus other problem substances between 2010/11 – 2015/16

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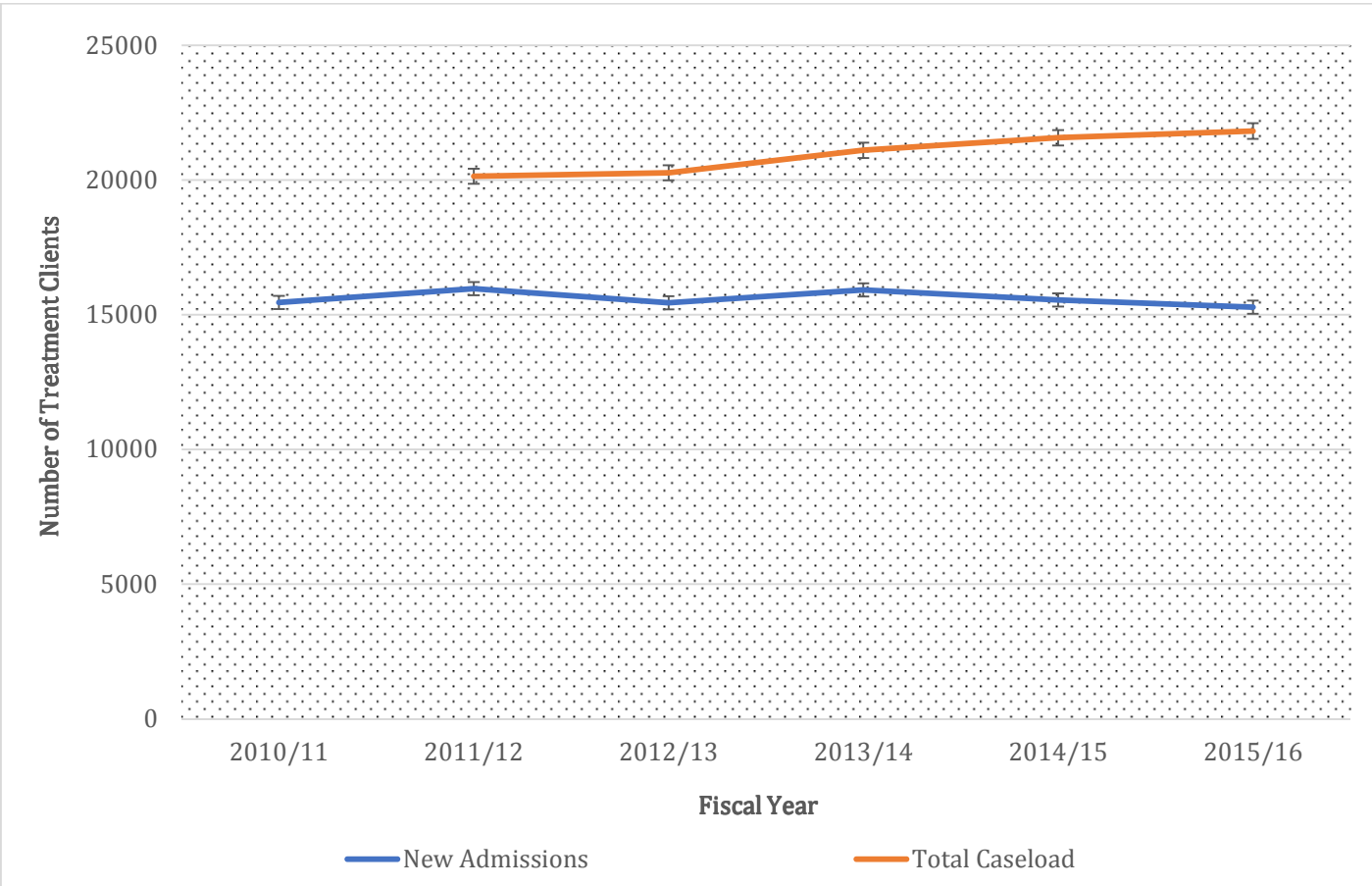
Supplementary Appendix To: Trends in Treatment for Cannabis Problems in Ontario: Fiscal Years 2010/11 to 2015/16

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Supplementary Tables

Table S1: Trends in new admissions and total caseload of clients receiving treatment for cannabis as the only problem substance and cannabis plus other problem substances between 2010/11 – 2015/16

Year	CO New Admissions		CO Total Caseload^		CP New Admissions		CP Total Caseload^	
	N	95% CI	N	95% CI	N	95% CI	N	95% CI
2010/11	2954	2848 - 3062	-	-	15451	15208 - 15697	-	-
2011/12	3086	2978 - 3197	4188	4062 - 4317	15966	15719 - 16216	20139	19862 - 20419
2012/13	2751	2649 - 2856	3978	3855 - 4104	15441	15198 - 15687	20264	19986 - 20545
2013/14	2689	2588 - 2793	3892	3771 - 4016	15918	15672 - 16167	21105	20821 - 21392
2014/15	2667	2567 - 2770	3889	3768 - 4013	15545	15302 - 15791	21569	21282 - 21859
2015/16	2342	2248 - 2439	3650	3533 - 3770	15280	15039 - 15524	21816	21527 - 22107
P-Value~	0.012		0.013		0.543		0.005	

Abbreviations: *CO*: cannabis as the only problem substance, *CP*: cannabis plus other problem substances, *CI*: confidence interval

^ Total caseload estimates were not generated for 2010/11

~ P-value obtained from the linear trend test

Table S2: Trends in rates of utilization of withdrawal management services among new admissions and total caseloads of clients receiving treatment for cannabis as the only problem substance and cannabis plus other problem substances between 2010/11 – 2015/16

Year	CO New Admissions Rate*	CO Total Caseload^ Rate*	CP New Admissions Rate*	CP Total Caseload^ Rate*
2010/11	4.74	-	31.66	-
2011/12	4.93	4.15	30.68	25.52
2012/13	4.80	3.92	28.20	22.90
2013/14	4.80	3.83	27.58	22.30
2014/15	5.70	4.81	29.17	23.33
2015/16	6.79	5.42	30.14	23.94
P-Value~	0.044	0.103	0.381	0.560

Abbreviations: *CO*: cannabis as the only problem substance, *CP*: cannabis plus other problem substances
* Rate per 100 clients
^ Total caseload estimates were not generated for 2010/11
~ P-value obtained from the linear trend test