Changes in the Rates of Alcohol- and Drug-related Hospital Separations for Canadian Provinces: 1996 to 2005

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ABSTRACT

Objective: This paper aims to present the rates of drug-related hospital separations for amphetamines, alcohol, cocaine, cannabis and opioids for each province from fiscal years 1996 to 2005.

Method: Data were drawn from Canada's Hospital Morbidity Database, a national electronic archive of all inpatient hospital admission records. All inpatient medical records with an alcohol- or drug-related diagnosis were abstracted for this study.

Results: Canadian rates increased during the 10-year period for all drugs; however, alcohol separations declined somewhat. The highest rates of drug and alcohol separations were most often found in BC, Alberta and the North. Nova Scotia and Newfoundland generally had the lowest rates of separations.

Conclusion: The study provides a detailed provincial and national account of alcohol- and drug-related morbidity related to inpatient hospital admissions. The rates of alcohol-related admissions across all provinces were, by far, much greater than those associated with drug-related episodes. The data provide an important measure of the harms related to substance use in Canada.

Key words: Alcohol; amphetamines; cocaine; opioids; cannabis; morbidity; hospitalization

In this paper, we have assembled data from fiscal years (FY) 1996 to 2005 (i.e., April 01, 1996-March 31, 2006) for each province on hospital separations for amphetamines, alcohol, cocaine, cannabis and opioids. To our knowledge, documentation of these rates has not been systematically reported for Canadian provinces. These data are useful for developing a comprehensive assessment of the national and provincial trends of alcohol- and drug-related harms. The hospital discharge data provide a more objective means of assessing health harms related to substance use compared to population surveys. Population surveys are commonly thought to result in under-reporting of harms because of poor recall, higher non-response rates of substance and problematic users, and social desirability effects due to the stigma of substance use or its illegal nature.[1,2]

A 2005 Canadian population survey has indicated the following percentage of the population reporting use of various substances in the past year: alcohol (79.3%), cannabis (14.1%), cocaine (1.9%) and LSD/speed/heroin (1.3%).[3] A question of interest is how these patterns translate into health-related harms through hospital separations. In Canada, substance-related morbidity data are reported by the Canadian Community Epidemiology Network on Drug Use (CCENDU),[4] but at this time, only national data for fiscal years 2001 and 2002 have been published and trend data by province is not available.

From an international perspective, this kind of data has been rarely reported. Recently, Australian rates have been reported for fiscal years 1999 to 2004.[5] They calculated hospital separation rates among 10,000 persons aged 15 to 54 to be approximately as fol-

lows: alcohol – 70, cannabis – 22, opioids – 18, amphetamines – 11, and cocaine – 1. Little is known about drug-related separation rates from other countries.

METHODS

In Canada, the Canadian Institute for Health Information (CIHI), a data repository for Canadian health issues, acts as the primary steward for hospital-record information. In this study, alcohol- and drug-related inpatient hospital episodes from April 01, 1996 to March 31, 2006 were drawn from CIHI's Hospital Morbidity Database (HMDB). The HMDB is a national database that captures administrative, clinical and demographic information on hospital inpatient events. It provides national discharge statistics from Canadian inpatient health care facilities by diagnoses and procedures. In the current study, we analyzed data from all acute care inpatient facilities from all provinces and territories. During the 1996-2006 timeframe in our study, the HMDB included annual data from approximately 700 acute care facilities across the country. The HMDB holding does not include discharge data from psychiatric facilities, day procedures (e.g., day surgeries), or Emergency Depart-

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Table 1. Rates of Separations per 100,000 Population by Province and Fiscal Year for Alcohol

Province	Year									
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
North	511	723	781	857	780	738	578	704	679	691
AB	358	354	343	350	357	357	298	278	288	271
BC	295	289	291	280	276	240	233	229	245	255
SK	N/A*	5	311	289	302	288	276	255	261	247
MB	285	286	272	279	266	262	251	237	227	215
ON	186	181	173	178	174	176	148	134	130	127
QC	185	190	197	204	211	216	202	212	203	N/A*
NB	230	232	228	252	268	275	257	184	167	173
PE	258	213	264	255	270	291	261	251	281	311
NS	263	263	256	226	192	154	158	147	147	127
NL	139	106	114	115	109	109	117	110	115	105
Canada	**218**	**227**	**225**	**227**	**225**	**221**	**199**	**191**	**189**	**182**

* N/A: not available
Rates were rounded to the nearest integer

Table 2. Rates of Separations per 100,000 Population by Province and Fiscal Year for Amphetamines

Province	Year									
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
North	2	1	0	2	2	3	8	7	7	7
AB	5	4	5	6	8	11	12	11	15	13
BC	2	3	3	5	7	11	14	20	26	33
SK	N/A*	0	9	10	12	12	14	12	17	11
MB	1	1	1	1	1	1	1	2	4	4
ON	2	2	2	2	2	2	2	3	4	4
QC	1	1	1	2	1	1	2	3	N/A*	0
NB	3	2	3	2	3	3	4	4	3	6
PE	3	1	4	3	2	5	5	2	4	1
NS	3	3	4	2	3	3	3	3	3	2
NL	1	2	2	1	1	2	2	1	3	2
Canada	**2**	**2**	**2**	**3**	**3**	**4**	**5**	**6**	**9**	**11**

* N/A: not available
Rates were rounded to the nearest integer

Table 3. Rates of Separations per 100,000 Population by Province and Fiscal Year for Cocaine

Province	Year									
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
North	27	34	56	43	80	36	57	74	97	112
AB	22	26	32	34	37	42	40	46	58	62
BC	61	68	77	80	80	71	74	82	98	113
SK	N/A*	0	9	9	10	10	16	27	28	34
MB	14	15	16	13	11	15	25	25	29	27
ON	14	13	14	16	16	17	14	16	20	24
QC	21	24	23	25	26	25	27	30	34	N/A*
NB	12	11	14	23	22	16	23	24	29	32
PE	1	7	3	4	4	6	8	8	11	20
NS	18	22	22	22	11	5	7	6	11	13
NL	1	1	1	3	2	1	3	3	5	6
Canada	**22**	**24**	**26**	**28**	**29**	**28**	**28**	**31**	**38**	**45**

* N/A: not available
Rates were rounded to the nearest integer

ment visits. Data were assembled from a special request to CIHI. Episodes were selected from acute inpatient records in the HMDB from fiscal years 1996 to 2005.

For each inpatient hospital episode, a record is created, containing up to 25 diagnosis fields, which indicate the primary diagnosis related to the patient's stay and all other relevant medical conditions. In the current study, all episodes with an alcohol or drug diagnosis, in any diagnostic position, were included in the analyses. The following ICD-9 and ICD-10 diagnostic codes were used to identify target episodes: for alcohol, 303, 305.0, 980.0, F10, T51.0; for cocaine, 304.2, 305.6, 968.5, F14, T40.5; for opioids, 304.0, 304.7, 305.5, 965.0, F11, T40.0-T40.4, T40.6; for cannabis, 304.3, 305.2, 969.6, F12, T40.7; and for amphetamine, 304.4, 305.7, 969.7, F15, T43.6.

Rates of separation for each province were calculated by dividing the number of separations for each substance by the total estimated population in each year and multiplying by 100,000. For ease of interpretation and comparison across provinces, we rounded decimals to the nearest integer (i.e., rounding up decimals ≥0.5 to the nearest whole number). Yearly population estimates for Canada and provinces were obtained from Statistics Canada.[6] The population for each year was estimated for June 30th by calculating the average between the second and third quarter.

Some data were missing. Saskatchewan did not report any HMDB data for 1996, and only partial figures for 1997. Quebec did not submit any figures for 2005. Populations were not included in the Canadian average from these two provinces for the years without data.

The Research Ethics Board at the Centre for Addiction and Mental Health approved the current secondary data analytic study, which did not include any personal identifiers in the data set.

Table 4. Rates of Separations per 100,000 Population by Province and Fiscal Year for Cannabis

| Province | Year | | | | | | | | | |
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
North	38	44	53	78	62	59	26	53	61	67
AB	28	33	34	41	48	51	48	47	49	41
BC	27	34	37	42	49	43	49	51	49	52
SK	N/A*	1	28	29	33	35	36	41	51	45
MB	14	14	17	18	17	23	28	26	29	30
ON	10	11	12	13	16	18	16	17	20	20
QC	9	10	12	18	22	25	28	35	38	N/A*
NB	16	15	22	33	37	45	48	42	44	45
PE	7	6	10	11	7	15	37	31	38	52
NS	31	36	38	38	24	20	29	28	29	27
NL	8	6	6	9	7	11	10	15	12	9
Canada	**14**	**17**	**19**	**23**	**26**	**27**	**29**	**31**	**33**	**31**

* N/A: not available
Rates were rounded to the nearest integer

Table 5. Rates of Separations per 100,000 Population by Province and Fiscal Year for Opioids

| Province | Year | | | | | | | | | |
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
North	6	10	13	28	34	24	18	26	36	31
AB	27	29	32	33	35	37	36	41	41	37
BC	58	69	74	77	72	64	59	58	68	75
SK	N/A*	0	24	30	35	33	38	39	41	40
MB	11	13	12	9	10	10	15	17	18	19
ON	13	13	15	17	17	18	19	20	22	23
QC	15	16	18	19	18	21	24	26	26	N/A*
NB	12	11	15	20	26	30	33	26	31	32
PE	4	6	11	11	21	17	25	27	38	31
NS	14	15	20	19	17	15	12	19	20	16
NL	6	7	9	9	10	8	9	13	17	13
Canada	**20**	**23**	**25**	**27**	**27**	**27**	**27**	**29**	**31**	**34**

* N/A: not available
Rates were rounded to the nearest integer

RESULTS

Tables 1 through 5 show the rates of separations for each province from fiscal years 1996 to 2005 for amphetamines, alcohol, cocaine, cannabis, and opioids. Important differences in trends of these Canadian provinces were noted. In relation to alcohol (Table 1), the absolute rate of separations is higher than all the other drugs combined at 182 separations per 100,000 persons in 2005. However, over the years there has been a modest decline. The North (including Nunavut, Northwest Territories and the Yukon) is considerably higher than other provinces and Alberta is slightly higher than the Canadian average.

The rates of amphetamines in Canada are low at just over 10 persons per 100,000 in 2005 but there has been nearly a sixfold increase in rates since 1996, with increases each year (see Table 2). Rates of separation have increased most dramatically in BC, from 2 in 1996 to 26 in 2005. Rates in Saskatchewan and Alberta are also above the Canadian average.

Rates of separation for cocaine have doubled during the 10-year study period with a Canadian average of 45 separations per 100,000 persons in 2005 (see Table 3). Provinces substantially above the Canadian average are BC, Alberta and the North. Newfoundland is notable for a very low rate of cocaine separations.

In terms of cannabis separations (see Table 4), the Canadian rate has doubled over the 10-year time period to 31 separations per 100,000 persons, but is still lower than cocaine. Higher rates were found in the North and Saskatchewan and low rates in Newfoundland and Ontario. Rates of separation for opioids increased from 20 to 34 during the 10-year period (see Table 5). BC is considerably above the Canadian average and Newfoundland and Nova Scotia had substantially lower rates.

Additional analyses were conducted to assess whether rates of separations correlate with provincial estimates of self-reported use or harms from the Canadian Addiction Survey (CAS).[3] Questions in the CAS survey included harms related to only alcohol (the AUDIT tool)[7] and cannabis (the ASSIST measure);[8] and for the drugs cocaine, speed and heroin, the proportion using in the past year was available. The means for each province were calculated and Spearman's Rho correlations were conducted with separations for each drug type. Although the sample sizes were small (n=10 provinces), statistical significance was found for amphetamines (r=.644, p<0.05), cocaine (r=.818, p<0.05) and cannabis (r=.638, p<0.05). Large but non-significant effect sizes were found for alcohol (r=.345) and opioids (r=.524).

DISCUSSION

Rates of hospital separations for cocaine, cannabis and opioids doubled from 1996 to 2005 and increased about sixfold for amphetamines. Separations for alcohol decreased marginally during the same period. The degree of changes in the rate of separations varied considerably across provinces. Alcohol-related separations in the North were over 3 times greater than the Canadian average. PEI and Alberta were higher than average. For other drugs, BC, the North and Alberta generally had higher rates of separations. The lowest rates of separations were generally found in Newfoundland and Nova Scotia.

It is not surprising that alcohol separation rates are much greater than other substances, given the high prevalence of use. However, prevalence of use is not the only indicator of health harms because not all substances are equally harmful to health. Comparison of health harms have been measured on several dimensions, includ-

ing acute versus chronic harms, intoxicating effects, and potential for dependence.[9] Comparison of the Canadian prevalence of use[3] and our hospital separations data indicate that alcohol is both the most prevalent drug (79.3%) and has the greatest burden of disease in terms of separations, with 182 per 100,000 population in 2005. Cocaine and opioids separations had the next highest burden; however, reported use is much lower (1.9% and less than 1% respectively) than cannabis.

The strong effect sizes between self-reported use of each substance from a randomized population survey and separations within each province suggest that the differences in rates of separations likely reflect meaningful provincial differences. As well, the correlations indicate that rates of separation are a good indicator of population-level problems associated with each drug.

Limitations

It is important to note that the current study relied on hospital administrative data, and such data usually underestimate patterns of both licit and illicit drug use in the general population. Only a small percentage of alcohol and drug users, for example, present to acute care hospitals with an alcohol- or drug-related condition. Also, alcohol and drug use problems usually have detection rates around 50% in inpatient settings.[10] ICD diagnoses of alcohol or drug problems in inpatient settings have high specificity but relatively low-to-moderate sensitivity.[11] In other words, alcohol or drug ICD diagnoses show a high likelihood of indicating an actual drug use problem, whereas the lack of an ICD alcohol or drug diagnosis does not reliably rule out the presence of an alcohol or drug disorder. As a result, the number of alcohol- and drug-related admissions in our study may more closely estimate the lower bound of alcohol- and drug-related admissions that actually occurred in acute care hospitals from 1996-2006. It is also important to note that our aggregated rates are derived from alcohol and drug diagnoses located in the electronic medical chart in different positions, ranging from 1st position (or primary condition responsible for the length-of-stay) to 25th position. In our aggregated rates, we weighted all diagnoses equally, regardless of diagnostic position in the medical chart record. While this is a standard process used in other similar epidemiological studies,[5] this process may have introduced some bias, especially if some alcohol or drug conditions were more likely to be recorded in the primary diagnostic position. Also, while the Canadian Institute of Health Information strives to make diagnostic coding guidelines uniform across the country, it is possible that actual coding practices varied across provinces, and these differences may have affected the rates in our study.

The alcohol and drug trends in our study relied on both ICD-9 and ICD-10 diagnostic systems. In 2001-2002, the ICD-10 system began to be implemented in inpatient settings in a staggered fashion across provinces in Canada, and by the start of 2002, only three provinces (New Brunswick, Manitoba, and Quebec) retained the ICD-9 system. New Brunswick began use of ICD-10 in 2003, Manitoba in 2004, and Quebec in 2006. Although a number of studies have urged caution in assuming a direct comparability of the ICD-9 and ICD-10 in relation to mortality statistics[12] and a wide range of alcohol-related harms,[13] studies have not yet examined the comparability of drug-related ICD-9 and ICD-10 codes. Our study focused on a narrow set of ICD-9 and ICD-10 alcohol and drug diagnoses primarily related to abuse, dependence and poisoning,

and researchers have not undertaken systematic study of the comparability of this abbreviated set of alcohol- and drug-related codes. As a result, readers should keep in mind the ICD-9-to-ICD-10 transition dates in their interpretation of the trends in this study.

REFERENCES

1. Kerr WC, Greenfield TK, Tujague J, Brown SE. A drink is a drink? Variation in the amount of alcohol contained in beer, wine and spirits drinks in a US methodological sample. *Alcohol Clin Exp Res* 2005;29(11):2015-21.
2. Stockwell T, Donath S, Cooper-Stanbury M, Catalano P, Mateo C. Under-reporting of alcohol consumption in household surveys: A comparison of quantity, frequency, graduated frequency and recent recall. *Addiction* 2004;99(8):1024-33.
3. Adlaf EM, Sawka E. Canadian Addiction Survey (CAS): A national survey of Canadians' use of alcohol and other drugs: Prevalence of use and related harms: Detailed report. Ottawa, ON: Canadian Centre on Substance Abuse, 2005.
4. Canadian Centre on Substance Abuse. Canadian Community Epidemiology Network on Drug Use (CCENDU) 2002 National Report: Drug trends and the CCENDU network. Ottawa: Canadian Centre on Substance Abuse, 2003.
5. Roxburgh A, Degenhardt L. Characteristics of drug-related hospital separations in Australia. *Drug Alcohol Depend* 2008;14(1-3):149-55.
6. Statistics Canada. Table 051-0005 estimates of population, Canada, provinces and territories, quarterly (15 series). Statistics Canada, Report No.: 051-0005, 2008 released on June 25, 2008.
7. Babor T, Higgins-Biddle JC, Saunders JB, Monteiro M (Eds.). *The Alcohol Use Disorders Identification Test: Guidelines for Use in Primary Care,* 2nd ed. Geneva, Switzerland: World Health Organization, 2001.
8. World Health Organization ASSIST Working Group. Alcohol, Smoking and Substance Involvement Screening Test (ASSIST): Development, reliability and feasibility. *Addiction* 2002;97(9):1183-94.
9. Nutt D, King LA, Saulsbury W. Development of a rational scale to assess the harm of drugs of potential misuse. *Lancet* 2007;369:1047-53.
10. Smothers BA, Yahr HT. Alcohol use disorder and illicit drug use in admissions to general hospitals in the United States. *Am J Addict* 2005;14(3):256-67.
11. Walkup JT, Boyer CA, Kellermann SL. Reliability of Medicaid claims files for use in psychiatric diagnoses and service delivery. *Admin Policy Men Health* 2000;27(3):129-39.
12. Statistics Canada. Comparability of ICD-10 and ICD-9 for mortality statistics in Canada. Catalogue no. 84-548-XIE ed. Ottawa, 2005.
13. Heale P, Chikritzhs T, Jonas H, Stockwell T, Dietze P. Estimated alcohol-caused deaths in Australia, 1990-97. *Drug Alcohol Rev* 2002;21(2):121-29.

RÉSUMÉ

Objectif : Présenter les taux de diagnostics-congés liés aux drogues (amphétamines, alcool, cocaïne, cannabis et opioïdes) dans chaque province pour les exercices financiers de 1996 à 2005.

Méthode : Les données sont tirées de la Base de données sur la morbidité hospitalière du Canada, un fichier électronique pancanadien où sont archivés tous les dossiers d'hospitalisation. Pour cette étude, nous en avons extrait les dossiers médicaux d'hospitalisation comportant un diagnostic lié à l'alcool ou à la drogue.

Résultats : Les taux au Canada ont augmenté pour toutes les drogues au cours de la période de référence de 10 ans, mais les taux de congés liés à l'alcool ont légèrement diminué. Les taux les plus élevés de congés liés à la drogue et à l'alcool ont été observés le plus souvent en Colombie-Britannique, en Alberta et dans le Nord. La Nouvelle-Écosse et Terre-Neuve présentaient en général les taux les plus faibles.

Conclusion : L'étude brosse un portrait provincial et national détaillé de la morbidité liée à l'alcool et à la drogue selon les dossiers d'hospitalisation. Dans toutes les provinces, les taux d'hospitalisation liés à l'alcool étaient de très loin supérieurs aux taux liés à la drogue. Ces données sont un important outil de mesure des méfaits de la consommation d'alcool ou de drogue au Canada.

Mots clés : alcool; amphétamines; cocaïne; opioïdes; cannabis; morbidité; hospitalisation