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Regional and sociodemographic variation of incident first-episode psychosis in Ontario, Canada

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Abstract

Introduction

Psychotic disorders are associated with high levels of disability and poor clinical outcomes but little is known about the regional incidence of psychosis in Ontario.

Objective

This study aimed to understand regional incidence variation and demographic and regional characteristics of individuals who may be suitable for receiving early psychosis intervention (EPI) services, as well as evaluate post-diagnosis healthcare utilisation.

Methods

A population-based retrospective cohort study captured incident affective and non-affective psychosis cases among Ontario, Canada residents aged 12-50 from 2017-2021. The sociodemographic characteristics of the cohort were described, including Ontario Health region of residence. Incident cases were followed for 6-months post-diagnosis to capture health service utilisation. Logistic regression was used to model post-diagnosis hospitalisations and Poisson regression to model outpatient psychiatrist visits.

Results

The cohort contained 44,188 individuals (41,257 non-affective psychosis; 3,058 affective psychosis). We observed substantial regional variation in incidence rates, which were higher in the North Western region for non-affective psychosis (167.44/100,000) and North Eastern region for affective psychosis (14.23/100,000) compared to the provincial average (92.24; 6.84/100,000, respectively). Compared to the Toronto region, post-diagnosis hospitalisations were significantly higher in the North East (non-affective psychosis aOR 1.14, 95%CI 1.01-1.30; affective psychosis aOR 1.69, 95%CI 1.13-2.54). Among those with non-affective psychosis, outpatient psychiatrist visits were significantly lower in all regions compared to Toronto (e.g., East aRR 0.61, 95%CI 0.60-0.62; North West aRR 0.34, 95%CI 0.32-0.36).

Conclusions

There is considerable regional variation in incident psychosis and inverse relationships between hospitalisations and outpatient care. To successfully plan for future EPI programs in Ontario, it is essential to understand regional needs using a systematic, population-based approach.

Keywords

schizophrenia spectrum and other psychotic disorders; psychotic disorders; community health planning; incidence; healthcare disparities

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Introduction

Psychotic disorders, both affective (e.g., bipolar disorder) and non-affective (e.g., schizophrenia and related disorders), are associated with high levels of disability and poor outcomes [1–4]. While its prevalence is relatively low, non-affective psychosis falls within the top 20 leading causes of disability globally [1], responsible for 13.4 (95% UI 9.9–16.7) million years lived with disability [2]. In terms of outcomes, approximately one in seven patients (median 13.5%) experience long-term (2-year) recovery [3]. Suicide rates are also markedly higher among patients with psychotic disorders when compared to the general population [4]. Psychotic disorders place a substantial burden on the healthcare system. In Ontario, the direct costs of psychosis care were approximately \$2.1 billion CAD in 2012 alone [5]. Indirect costs of psychotic disorders are also extremely high [6].

Early psychosis intervention (EPI) plays a key role in improving functional and clinical outcomes among those with first episode psychosis [7–10] and is widely recommended upon diagnosis [11]. In Ontario, health quality standards recommend that EPI should be available for all newly diagnosed patients, ideally within the first two weeks [12]. As of present, there are approximately 60 EPI programs across Ontario. However, there are many more EPI cases than are treated in these programs. In one Ontario catchment area, Anderson and colleagues found a rate of non-affective psychosis incidence of 33.3 per 100,000 per year, compared to the 18.8 per 100,000 per year who received EPI treatment in the same region, a nearly 2-fold difference in incidence vs. access to treatment [13]. While a proportion of the untreated cases may not have met the criteria for EPI program entry, these data suggest that not all individuals diagnosed with a psychotic disorder are receiving EPI.

Sociodemographic factors such as age, sex, socioeconomic status, and immigration status play a role in both the incidence of psychotic disorder [14–17] and access to EPI treatment [18]. Males, recent immigrants, those living in lower income areas, and those with a previous mental disorder are at greater risk of incident psychosis [14–17]. Accurate information on the regional incidence of first-episode psychosis is essential to close the gap between population-based incidence and treated incidence, which will, in turn, improve population-based outcomes in this population.

Ontario, the most populous Canadian province (~16 million), is made up of six health regions which vary in their sociodemographic makeup and healthcare needs [19]. The Toronto health region (population ~3.3 million) serves the most densely populated area of the province and contains a high concentration of specialised services. In contrast, the North East (population ~600,000) and North West (population ~240,000) health regions serve largely rural areas with higher proportions of Indigenous and Francophone residents. These regions experience healthcare inequities, such as those related to mortality and chronic disease, when compared to Ontario as a whole [20]. There are also lower rates of primary care attachment and higher specialist wait times in the Northern regions. Provincial psychiatrist supply varies from 62.7 per 100,000 in the Toronto area to 7.2 per 100,000 in lower-supply (largely Northern) areas [21]. These care

inequities are perhaps driven by factors such as low population density, poor infrastructure, lack of trained providers, language barriers, and challenging weather conditions [20]. Previous research has shown regional variation in healthcare provision and clinical outcomes within the province [22–25], yet there is little evidence on the regional incidence of first-episode psychosis, both alone and by relevant sociodemographic factors, and variation in access to care [26].

Due to the importance of proper allocation of EPI services and Ontario's regional variation in health outcomes, we conducted a population-based retrospective cohort study aiming: (1) to understand the variation in demographic and regional characteristics of individuals who may be suitable for EPI services in the province of Ontario, and (2) to determine healthcare utilisation after first diagnosis of a psychotic disorder.

Methods

Study design and population

This population-based retrospective cohort study included two distinct populations, incident affective and non-affective psychosis, of Ontario, Canada residents aged 12–50 between January 1st 2017–December 31st 2021, who were eligible for Ontario's Health Insurance Plan (OHIP). Individuals were excluded from the cohort if they had an invalid birth and/or death date, invalid gender, were a non-Ontario resident, were ineligible for OHIP coverage, were aged less than 12 or greater than 50 years or had a prior diagnosis of a psychotic disorder. To create this cohort, we used health administrative databases housed at ICES (formerly the Institute for Clinical Evaluative Sciences), an independent, non-profit research institute funded by an annual grant from the Ontario Ministry of Health (MOH) and the Ministry of Long-Term Care (MLTC). As a prescribed entity under Ontario's privacy legislation, ICES is authorised to collect and use health care data for the purposes of health system analysis, evaluation and decision support. Secure access to these data is governed by policies and procedures that are approved by the Information and Privacy Commissioner of Ontario.

Data sources

Health and demographic administrative data were accessed from various data sources housed at ICES, including the National Ambulatory Care Reporting System (NACRS), the Canadian Institute for Health Information's Discharge Abstract Database (DAD), the Ontario Mental Health Reporting System (OMHRS), the Registered Persons Database (RPDB), and the Immigration, Refugees and Citizenship Canada (IRCC) Permanent Residents database (Supplementary Material Table 1). NACRS was used to identify emergency department visits. DAD and OMHRS were used to identify hospital admissions, where, at ICES, records are linked together to form 'episodes of care' among the hospitals to which patients have been transferred after initial admission. RPDB was used to provide demographic information such as age, sex, date of birth, date of death, etc. for those with an OHIP number, and to create the yearly denominator. The IRCC Permanent Residents

database was used to capture immigration status. These datasets were linked using unique encoded identifiers and analysed at ICES.

Exposure

The main exposure was incident cases of psychotic disorder, defined as: 1) a discharge diagnosis of psychotic disorder in OMHRS, (2) a most responsible diagnosis of psychotic disorder in DAD, or (3) at least two outpatient claims (OHIP physician billing claims and/or emergency department (ED) visits) with a diagnostic code for psychotic disorder within a 12-month period (for diagnostic codes, see Supplementary Material Table 2) [27]. Incidence was defined as no prior diagnosis of affective or non-affective psychosis, across the individual's lifetime, prior to the first hospitalisation diagnosis or outpatient diagnosis respectively.

Outcomes

Incident cases were followed for 6 months or until death or loss of OHIP eligibility to capture the following service use outcomes starting the day after incident discharge: mental health and addictions (MHA)-related acute care visits (ED visits and hospitalisations), MHA-related hospitalisation length of stay, and MHA-related outpatient visits (primary care visits, psychiatrist visits, and paediatrician visits). Paediatrician visits were reported separately as Ontario policy dictates that paediatricians can only see patients up to 18 years of age. Outcomes were reported by non-affective and affective psychosis separately. If an individual was seen in the ED and subsequently admitted, this was considered as a hospitalisation only (not an ED visit). If cases were identified in a hospital setting, they were followed for 6 months after date of discharge. If an individual had more than one hospitalisation, the index hospitalisation was used for those who entered the cohort via hospitalisation. The first hospitalisation for individuals was used in the non-affective hospitalisation cohort who happened to have a hospitalisation in the follow-up period. If cases were identified in an outpatient setting, they were followed for 6 months after date of first OHIP billing/ED visit.

Covariates

The following sociodemographic covariates for incident cases by psychosis type were included: age group (12-13, 14-20, 21-25, 26-30, 31-35, 36-40, 41-45, 46-50), sex (female, male), income quintile (1, 2, 3, 4, 5, missing), rurality (rural, urban, missing), immigration (immigrant, non-immigrant, other immigrants, refugee), and health region (Central, East, North East, North West, Toronto, West). Income quintile is a measure of relative household income at the neighbourhood level, where quintile 1 contains the lowest incomes and quintile 5 contains the highest incomes. Several health service utilisation characteristics were captured in the year before diagnosis: MHA-related ED visits, MHA-related hospitalisations, and MHA-related outpatient visits (primary care visits, psychiatrist visits, and paediatrician visits).

Statistical analysis

All analyses were performed for affective cases and non-affective cases separately (patients with both diagnoses appeared in both cohorts). We described the cohorts using frequencies and proportions. Population-based incidence rates per 100,000 were presented overall and for each health region. Rates were presented overall, by sex, age group, site of diagnosis (non-affective cases only), and physician specialty (non-affective outpatient cases only). Rates were calculated using population estimates as the denominator. For example, age-specific rates used age-specific population estimates and health region-specific rates used health region-specific estimates.

The six-month mental health service use outcomes were presented as frequencies, both overall and for each health region. Logistic regression was used to model MHA-related hospitalisations and MHA-related ED visits. Poisson regression was used to model MHA-related primary care visits. We were not able to model MHA-related psychiatrist visits and paediatrician visits for affective psychosis due to small outcome numbers. For each outcome, models were presented as unadjusted, adjusted for sociodemographic characteristics, and adjusted for sociodemographic characteristics as well as pre-diagnosis health service utilisation.

All analyses were conducted using SAS Enterprise Guide version 8.3. Mapping of incidence rates was conducted using Tableau software.

Results

We identified 425,724 individuals with first episode psychosis, 347,653 of which were outside of the study accrual window. Another 33,883 individuals were excluded because they could not be linked across databases ($n = 11$), did not meet the age criteria ($n = 33,146$), were non-Ontario residents ($n = 519$), were not eligible for OHIP ($n = 182$), or had problematic or missing data ($n = 25$), resulting in a final sample of 44,188 Ontarians aged 12-50 who were diagnosed with first episode psychosis between January 1st 2017 and December 31st 2021 (Supplementary Material Figure 1). Of these individuals, 41,257 had non-affective psychosis and 3,058 had affective psychosis (127 were diagnosed with both). Table 1 shows the baseline characteristics for both the non-affective and affective psychosis cohorts. Overall, affective psychosis disorders were most common in females (54.7%) and those aged 14-20 (24.5%), while non-affective psychosis disorders were more common in males (60.3%) and those aged 21-25 (20.4%). Higher numbers of incident cases were observed in the lowest income quintile, regardless of psychosis type (Table 1). One year prior to their incident psychosis case, approximately 30% of individuals had 2+ MHA-related visits to a family physician, regardless of psychosis type (Table 1).

Figures 1a and 1b display heat maps of incidence by health region for affective and non-affective cases, respectively. The overall rate of affective psychosis was 6.84 per 100,000 (Supplementary Material Table 3). The overall rate of non-affective psychosis was 92.24 per 100,000. Non-affective psychosis rates were highest in the North West and North East regions at 167.44 per 100,000 and 134.67 per 100,000,

Table 1: Baseline characteristics of incident cases of 1st episode psychosis in Ontario population aged 12-50 years (January 1, 2017–December 31st, 2021), by psychosis type

Variable	Value	Affective (n = 3,058)		Non-affective (n = 41,257)	
		n	%	n	%
Sociodemographic characteristics					
Age group (years)	12-13	58	1.9	404	1.0
	14–20	750	24.5	8,185	19.8
	21–25	496	16.2	8,407	20.4
	26–30	482	15.8	6,834	16.6
	31–35	375	12.3	5,690	13.8
	36–40	344	11.2	4,572	11.1
	41–45	266	8.7	3,691	8.9
	46–50	287	9.4	3,474	8.4
Sex	Female	1,672	54.7	16,392	39.7
	Male	1,386	45.3	24,865	60.3
Income quintile	1 (Lowest)	829	27.1	12,494	30.3
	2	648	21.2	8,706	21.1
	3	584	19.1	7,322	17.7
	4	526	17.2	6,276	15.2
	5 (Highest)	455	14.9	5,949	14.4
	Missing	16	0.5	510	1.2
Rural	Rural	244	8.0	3,757	9.1
	Urban	2,799	91.5	37,005	89.7
	Missing	15	0.5	495	1.2
Immigration category	Immigrants	448	14.7	4,970	12.0
	Non-immigrants	2,477	81.0	34,196	82.9
	Other immigrants	12	0.4	171	0.4
	Refugees	121	4.0	1,920	4.7
Health region	Central	951	31.1	11,783	28.6
	East	551	18.0	10,152	24.6
	North East	211	6.9	1,997	4.8
	North West	25	0.8	1,191	2.9
	Toronto	359	11.7	4,593	11.1
	West	961	31.4	11,541	28.0
Health service use (one year before index date)					
Number of MHA-related hospitalisations	0	2,509	82.0	32,461	78.7
	1	431	14.1	6,986	16.9
	2+	118	3.9	1,810	4.4
Number of MHA-related ED visits	0	1,419	46.4	24,092	58.4
	1	986	32.2	10,236	24.8
	2+	653	21.4	6,929	16.8
Number of MHA-related psychiatrist visits	0	1,804	59.0	27,532	66.7
	1	407	13.3	4,713	11.4
	2+	847	27.7	9,012	21.8
Number of MHA-related GP/FP visit	0	1,240	40.5	18,365	44.5
	1	892	29.2	11,183	27.1
	2+	926	30.3	11,709	28.4
Number of MHA-related paediatrician visits	0	2,939	96.1	40,138	97.3
	1	119	3.9	1,119	2.7
	2+	2,509	82.0	32,461	78.7

MHA = mental health and addictions; ED = emergency department; GP/FP = general practice/family practice.

Figure 1a: Rates per 100,000 of incident cases of 1st episode affective psychosis in Ontario population aged 12–50 years (January 1, 2017–December 31st, 2021), by Ontario Health region (heat map). Denominators used year and health region-specific estimates.

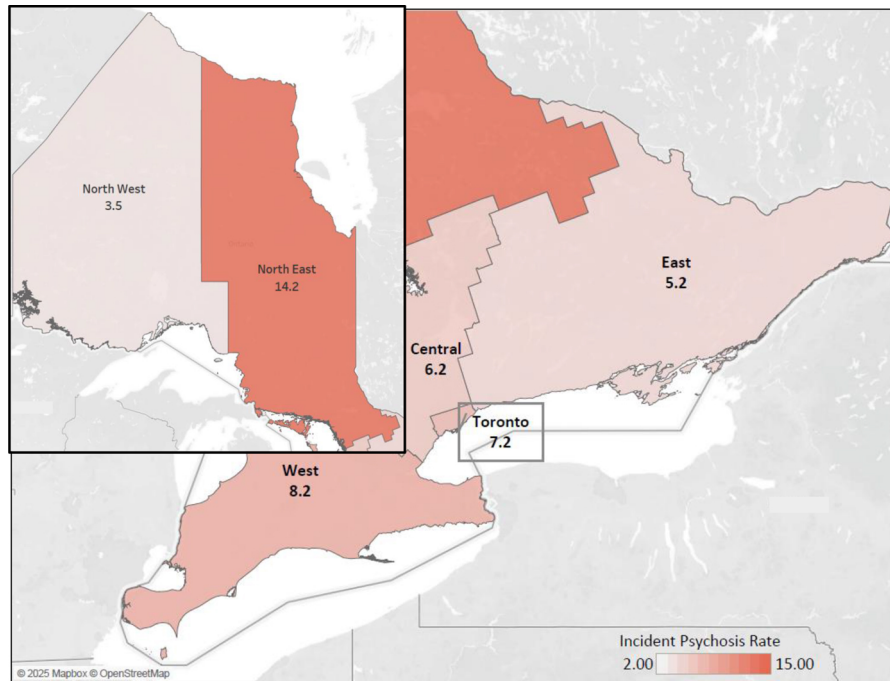
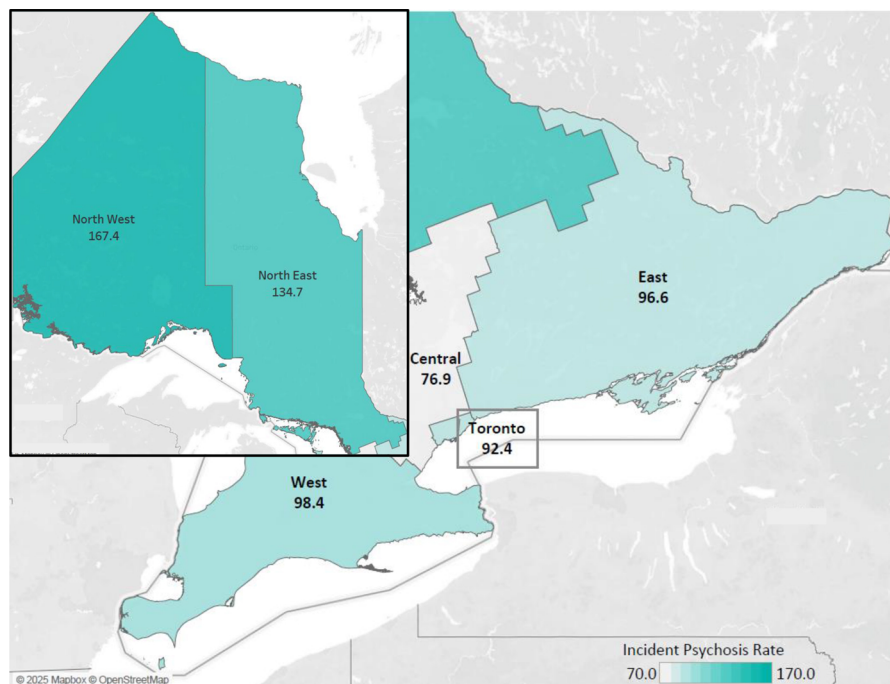


Figure 1b: Rates per 100,000 of incident cases of 1st episode non-affective psychosis in Ontario population aged 12–50 years (January 1, 2017–December 31st, 2021), by Ontario Health region (heat map). Denominators used year and health region-specific estimates.



respectively, while affective psychosis rates were highest in the North East region at 14.23 per 100,000 (Figures 1a, 1b). In the North West region, the rate of affective psychosis was 3.51 per 100,000. Across health regions, incidence of cases diagnosed in an outpatient setting was approximately 2–3 times higher than that of those diagnosed in an inpatient setting. The highest rates of outpatient diagnoses took place in the North West and North East regions.

Table 2 displays the 6-month MHA-related outcomes after incident case diagnosis for the affective and non-affective cohorts, by health region. In the non-affective cohort, most patients had at least two outpatient psychiatrist visits and at least one outpatient primary care visit within the 6 months post-diagnosis. Across the province, 21.5% of the cohort had at least one ED visit and 26.5% had at least one hospitalisation during this time period. Compared to the provincial average,

Table 2: 6-month mental health and addictions service use outcomes for incident cases of 1st episode psychosis in Ontario population aged 12-50 years (January 1, 2017–December 31st, 2021), by Ontario Health region and psychosis type

Variable	Value	Ontario Health Region													
Affective psychosis															
		Overall (N = 3,058)		Central (n = 951)		East (n = 551)		North East (n = 211)		North West (n = 25)		Toronto (n = 359)		West (n = 961)	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%
MHA-related psychiatrist outpatient visits	0	649	21.2	192	20.2	115	20.9	62	29.4	17	68	50	13.9	213	22.2
	1	335-340		112	11.8	56	10.2	36	17.1	1-5		22	6.1	109	11.3
	2+	2,068-2,073		647	68	380	69	113	53.6	3-7		287	79.9	639	66.5
MHA-related primary care outpatient visits	0	1,219	39.9	344	36.2	253	45.9	98	46.4	10	40	134	37.3	380	39.5
	1-2	1,051	34.4	347	36.5	167	30.3	66	31.3	9	36	122	34	340	35.4
	3+	788	25.8	260	27.3	131	23.8	47	22.3	6	24	103	28.7	241	25.1
MHA-related paediatrician visits	0	2,982	97.5	933	98.1	539	97.8	199	94.3	25	100	348	96.9	938	97.6
	1+	76	2.5	18	1.9	12	2.2	12	5.7	0	0	11	3.1	23	2.4
MHA-related ED visits	0	2,520	82.4	814	85.6	457	82.9	160	75.8	18	72	290	80.8	781	81.3
	1	366-371		95	10	65	11.8	33	15.6	2-6		53	14.8	119	12.4
	2+	166-171		42	4.4	29	5.3	18	8.5	1-5		16	4.5	61	6.3
MHA-related hospitalisations	0	2,298-2,303		736	77.4	417	75.7	138	65.4	20-24		280	78	708	73.7
	1	535-540		156	16.4	103	18.7	49	23.2	1-5		53	14.8	174	18.1
	2+	219-224		59	6.2	31	5.6	24	11.4	1-5		26	7.2	79	8.2
MHA-related hospitalisation length of stay (days)	1-7	794	26	247	26	128	23.2	68	32.2	7	28	99	27.6	245	25.5
	8-14	962	31.5	337	35.4	174	31.6	55	26.1	11	44	99	27.6	286	29.8
	15-21	606-611		185	19.5	102	18.5	48	22.7	2-6		86	24	184	19.1
	22-28	250-255		80	8.4	47	8.5	13	6.2	1-5		24	6.7	86	8.9
	29+	440-445		102	10.7	100	18.1	27	12.8	1-5		51	14.2	160	16.6
Death (any cause)	Yes	23	0.8	10	1.1	1-5		1-5		0	0	1-5		6	0.6
Non-Affective Psychosis															
		Overall (N = 41,257)		Central (n = 11,783)		East (n = 10,152)		North East (n = 1,997)		North West (n = 1,191)		Toronto (n = 4,593)		West (n = 11,541)	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%
MHA-related psychiatrist outpatient visits	0	13,960	33.8	3,805	32.3	3,781	37.2	892	44.7	688	57.8	1,178	25.6	3,616	31.3
	1	6,291	15.2	1,763	15.0	1,577	15.5	358	17.9	208	17.5	610	13.3	1,775	15.4
	2+	21,006	50.9	6,215	52.7	4,794	47.2	747	37.4	295	24.8	2,805	61.1	6,150	53.3
MHA-related primary care outpatient visits	0	15,934	38.6	4,392	37.3	3,847	37.9	865	43.3	525	44.1	1,768	38.5	4,537	39.3
	1-2	13,167	31.9	3,890	33.0	3,232	31.8	606	30.3	345	29.0	1,391	30.3	3,703	32.1
	3+	12,156	29.5	3,501	29.7	3,073	30.3	526	26.3	321	27.0	1,434	31.2	3,301	28.6

Continued

Table 2: Continued

Variable	Value	Ontario Health Region													
		Overall (N = 41,257)		Central (n = 11,783)		East (n = 10,152)		North East (n = 1,997)		North West (n = 1,191)		Toronto (n = 4,593)		West (n = 11,541)	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%
Non-Affective Psychosis															
MHA-related paediatrician visits	0	40,510	98.2	11,554	98.1	10,034	98.8	1,956	97.9	1,152	96.7	4,518	98.4	11,296	97.9
	1+	747	1.8	229	1.9	118	1.2	41	2.1	39	3.3	75	1.6	245	2.1
MHA-related ED visits	0	32,371	78.5	9,518	80.8	7,948	78.3	1,481	74.2	865	2.6	3,514	76.5	9,045	78.4
	1	5,372	13	1,485	12.6	1,327	13.1	304	15.2	185	15.5	593	12.9	1,478	12.8
	2+	3,514	8.5	780	6.6	877	8.6	212	10.6	141	11.8	486	10.6	1,018	8.8
MHA-related hospitalisations	0	30,343	73.5	8,672	73.6	7,509	74.0	1,354	67.8	813	68.3	3,384	73.7	8,611	74.6
	1	7,782	18.9	2,255	19.1	1,873	18.4	431	21.6	266	22.3	861	18.7	2,096	18.2
	2+	3,132	7.6	856	7.3	770	7.6	212	10.6	112	9.4	348	7.6	834	7.2
MHA-related hospitalisation length of stay (days)	1-7	6,306	15.3	1,782	15.1	1,634	16.1	369	18.5	222	18.6	706	15.4	1,593	13.8
	8-14	3,569	8.7	1,141	9.7	846	8.3	210	10.5	111	9.3	352	7.7	909	7.9
	15-21	2,003	4.9	579	4.9	501	4.9	99	5.0	47	3.9	223	4.9	554	4.8
	22-28	863	2.1	253	2.1	188	1.9	40	2.0	24	2.0	105	2.3	253	2.2
	29+	1,955	4.7	465	3.9	448	4.4	119	6.0	48	4.0	221	4.8	654	5.7
	N/A	26,561	64.4	7,563	64.2	6,535	64.4	1,160	58.1	739	62.0	2,986	65.0	7,578	65.7
Death (any cause)	Yes	331	0.8	85	0.7	80	0.8	17	0.9	10	0.8	51	1.1	88	0.8

MHA = mental health and addictions; ED = emergency department.

non-affective psychosis patients in the North East and North West health regions had a smaller proportion of outpatient psychiatrist and primary care visits and a larger proportion of ED visits and hospitalisations. The Toronto region had the highest proportion of outpatient psychiatrist visits (74.4% with one or more) and the Central region had the highest proportion of outpatient primary care visits (62.7% with one or more). Across the province, 0.8% of the non-affective psychosis cohort died within the first 6 months of diagnosis. Overall, similar results were seen for the affective cohort. However, the most common length of stay for hospitalisation was 8-14 days for the affective cohort and 1-7 days for the non-affective cohort.

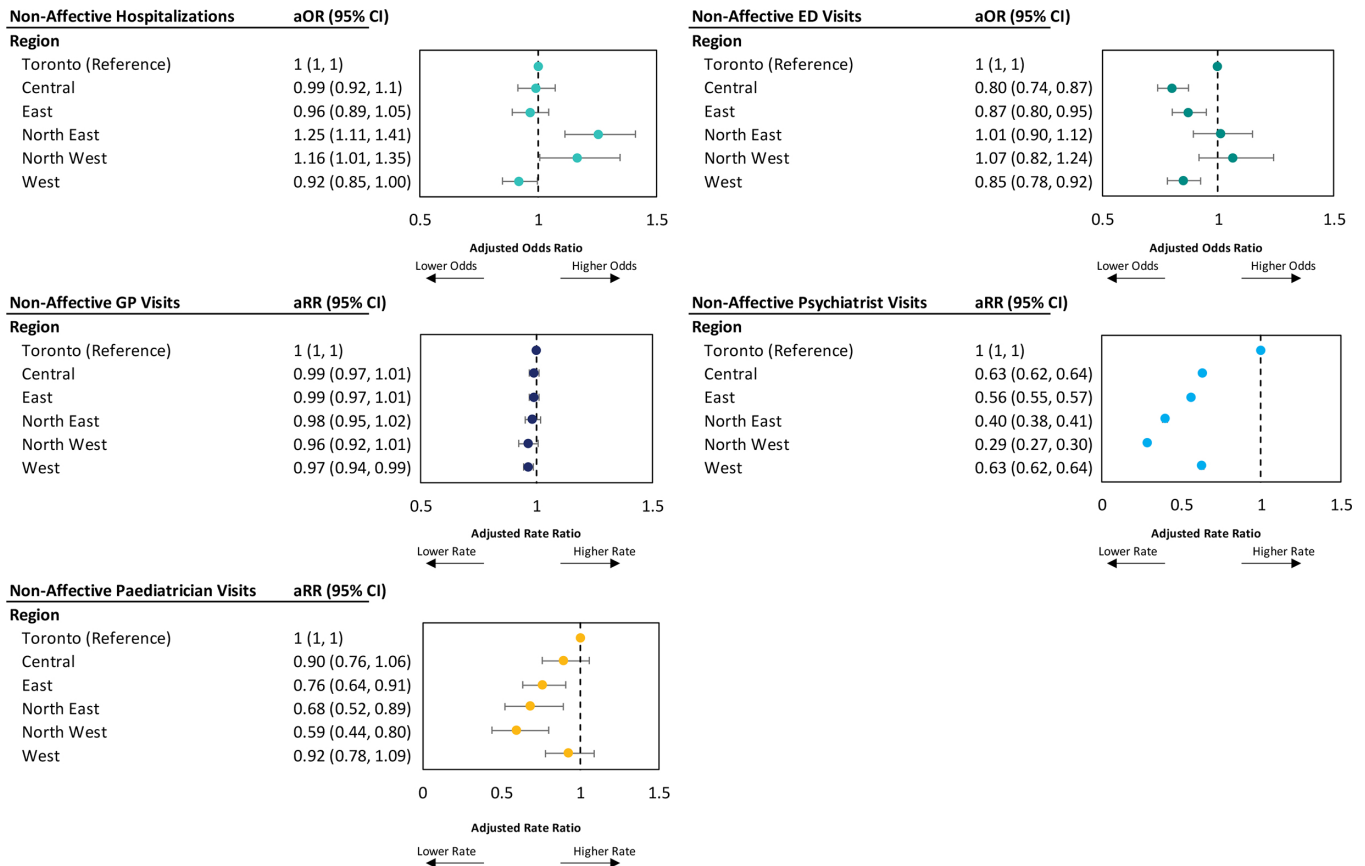
Figure 2 displays the adjusted odds ratios (aOR) of 6-month MHA ED visit and hospitalisation, and adjusted rate ratios (aRR) of 6-month outpatient visits for incident non-affective psychosis cases, by health region (adjusted for sociodemographic characteristics; Supplementary Material Tables 4, 5). Compared to the referent health region of Toronto, both the North East and North West regions had higher odds of hospitalisation (aOR [95% CI] 1.25 [1.1,1.41], 1.16 [1.01,1.35], respectively) and ED visits (aOR 1.01 [0.90,1.12], 1.07 [0.82,1.24], respectively). The odds of individuals in the Central health region having an MHA-related ED visit within 6-months of their incident case diagnosis

was 20% less (aOR 0.80 [0.74,0.87]) than those residing in Toronto. For outpatient visits, highest rates were seen across the health regions for primary care, followed by paediatricians (Figure 2). The lowest rates were seen for psychiatrist visits, especially in the North West (aRR 0.29 [0.27,0.30]) and North East (aRR 0.40 [0.38,0.41]) regions. No regional differences were observed for 6-month MHA-related health care use among patients with affective psychosis, except for primary care visits. Individuals had lower rates of primary care visits in most regions when compared to Toronto, with North East having the lowest rates (aRR 0.85 [0.74,0.96]) and Central having the highest (aRR 1.096 [1.007-1.193]) (Supplementary Material Table 5). Adjusting for previous health service utilisation in addition to sociodemographic characteristics did not produce meaningfully different results (Supplementary Tables 6, 7).

Discussion

Our cohort contained 44,188 Ontarians aged 12-50 diagnosed with first-episode psychosis between 2017 and 2021. Within this population, we observed significant regional variation in incidence rates. Rates were higher in the Northern and Western

Figure 2: Adjusted odds ratio (aOR) of 6-month mental health and addictions emergency department visit and hospitalisation outcomes, and adjusted rate ratio (aRR) of 6-month outpatient visit outcomes for incident cases of 1st episode non-affective psychosis in Ontario population aged 12-50 years (January 1, 2017–December 31st, 2021)



Note: all models were adjusted for sex, age, neighbourhood income quintile, rurality, and immigration status. ED = emergency department; GP = general practice.

health regions compared to the provincial average, ranging as high as 167 per 100,000 (non-affective psychosis; North West region). In addition to regional variation in incidence, we also identified differences in healthcare utilisation during the first six months following psychotic illness onset. Namely, the odds of hospitalisation and ED visits were higher among patients in the Northern health regions, while the Central and Toronto regions had higher rates of outpatient visits. Conversely, regions with high hospitalisation rates had the lowest per capita psychiatrist visit rates, whereas the regions with the lowest hospitalisation rates had the highest per capita psychiatrist visit rates.

To successfully plan for future EPI programs in Ontario, it is essential to understand regional needs based on the actual number of cases requiring intervention using a systematic, population-based approach. Our population-based study found significant and meaningful regional variation in the incidence of first episode psychosis. In 2022, Rotenberg and colleagues published an investigation of incident psychosis cases in Ontario, also identifying notable regional variation. In general, the authors found elevated rates of psychotic disorder in the metropolitan areas of Toronto, Southeastern Ontario (e.g., Kingston), Southwestern Ontario (e.g., Guelph, Windsor), and Northern Ontario (Sudbury) compared to non-metropolitan rural areas [26]. Overall, improving our understanding of these

regional incidence variations will help address the gap between psychosis incidence (demand) and EPI service availability (supply) across the province. Regional variation was also present in health care utilisation within six months post-diagnosis. Patients in the Northern health regions had lower rates of mental health-related outpatient psychiatrist and primary care specialist visits and higher odds of mental health-related ED visits and hospitalisations. Other regions, such as the Central and Toronto regions, had higher rates of outpatient mental health visits. These patterns are important to consider from a healthcare system planning perspective, where resources could be saved by diverting care to outpatient services. Our finding of relatively low use of outpatient care is consistent with findings from the Southwest region of Ontario, where prior studies have shown less than half of individuals who appear to be eligible for EPI services receive them [18].

As discussed above, we observed differences in both incidence of disease and post-diagnosis care for Northern populations compared to the rest of the province. There is a need for more psychiatrists and family physicians in these regions to help increase outpatient follow-up and decrease burden on acute care centers. Rotenberg et al. explored physician follow-up after hospitalisation among patients with schizophrenia, finding that the greatest proportion of individuals who received timely follow-up

from both psychiatrists and physicians (psychiatrists/general practitioners) often lived in health regions with the largest metropolitan centers (Toronto, Ottawa, and Hamilton) [28]. There is also drastic variation in the availability of psychiatrists, with the vast majority practicing in Toronto and very few in the Northern regions [21]. Various strategies have been proposed to improve access to general and specialized outpatient care in the Northern regions, such as establishing health centres with interprofessional teams, implementing telemedicine or mobile clinics in remote areas, and providing education and training to retain Northern-born professionals [20].

Incidence of psychosis was high in the Northern health regions. The proportion of individuals who identify as Indigenous in these regions is also high [19]. Other jurisdictions have reported higher rates of psychosis among Indigenous populations compared to non-Indigenous populations. In a New Zealand cohort study, rates of psychosis were higher among the Indigenous population compared to the non-Indigenous population after adjusting for age, sex, deprivation, and urbanicity [29]. Reasons for the increased incidence of psychotic illnesses in regions with large Indigenous populations should be a focus of further study. In terms of access to mental health care, Indigenous individuals face barriers including lack of awareness of available services, lack of access to services (including long wait times, lack of Indigenous providers, and language barriers), mistrust of formal services, and stigma surrounding services [30]. In Canada, a growing body of literature has demonstrated inequities in mental health and substance use rates among Indigenous peoples compared to the general population [31–33]. We also identified differences in rates of psychosis between the two Northern health regions, which could be related to the proportion of residents identifying as Indigenous in the North East (13.6%) compared to the North West (26.4%) [19].

A strength of our study was its use of population-based health administrative data, which allowed us to gain a better understanding of regional incidence in Ontario. These data may be useful for informing future EPI program resource allocation. This study also had several limitations. Administrative health data may have missing or inaccurate values; however, these issues are likely non-differential. In addition, while we used a pre-existing algorithm to identify psychosis cases, this technique may not be entirely sensitive or specific [27]. Lastly, factors that we could not measure may also play a role in first-episode psychosis. For example, we were unable to look at the role of race/ethnicity and data on income were only available at the area level.

Conclusion

We observed substantial regional variation in incidence of first-episode psychosis in Ontario. Specifically, rates were highest in the Northern and Western health regions. We also identified variation by other sociodemographic characteristics, as well as regional variation in post-diagnosis health service utilisation. Regions with high hospitalisation rates had the lowest per capita psychiatrist visit rates, whereas the regions with the lowest hospitalisation rates had the highest per capita psychiatrist visit rates. Additional research is needed to further

understand regional variation and to isolate the effects of specific factors. This type of work can be applied to other jurisdictions, promoting the use of evidence-based decisions for EPI policy. These data can also be applied to the future development of EPI services in Ontario, helping to better align EPI resources based on measured regional need.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Ethics statement

ICES is a prescribed entity under Ontario's Personal Health Information Protection Act (PHIPA). Section 45 of PHIPA authorizes ICES to collect personal health information, without consent, for the purpose of analysis or compiling statistical information with respect to the management of, evaluation or monitoring of, the allocation of resources to or planning for all or part of the health system. Projects that use data collected by ICES under section 45 of PHIPA, and use no other data, are exempt from REB review. The use of the data in this project is authorised under section 45 and approved by ICES' Privacy and Legal Office.

Data availability

The dataset from this study is held securely in coded form at ICES. While legal data sharing agreements between ICES and data providers (e.g., healthcare organisations and government) prohibit ICES from making the dataset publicly available, access may be granted to those who meet pre-specified criteria for confidential access, available at www.ices.on.ca/DAS (email: das@ices.on.ca). The full dataset creation plan and underlying analytic code are available from the authors upon request, understanding that the computer programs may rely

upon coding templates or macros that are unique to ICES and are therefore either inaccessible or may require modification.

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Abbreviations

EPI:	early psychosis intervention
MHA:	mental health and addictions
OHIP:	Ontario's Health Insurance Plan
NACRS:	National Ambulatory Care Reporting System
DAD:	Canadian Institute for Health Information's Discharge Abstract Database
OMHRS:	Ontario Mental Health Reporting System
RPDB:	Registered Persons Database
IRCC:	Immigration, Refugees and Citizenship Canada
ED:	emergency department
GP/FP:	general practice/family practice
aOR:	adjusted odds ratio
aRR:	adjusted relative risk

Supplementary appendices

- **Supplementary Table 1:** Summary of the health administrative databases used for the study.
- **Supplementary Table 2:** Non-affective and affective psychosis definitions (ICD-9-CM and ICD-10 codes).
- **Supplementary Figure 1:** Exclusions for cohort of incident cases of 1st episode psychosis.
- **Supplementary Table 3:** Rates per 100,000 for incident cases of 1st episode psychosis in Ontario population aged 12-50 years (January 1, 2017–December 31st, 2021), by Ontario Health region and psychosis type.
- **Supplementary Table 4:** Results from the logistic regression models for 6-month mental health and addictions ED visit and hospitalisation outcomes for incident cases of 1st episode psychosis in Ontario population aged 12-50 years (January 1, 2017–December 31st, 2021), adjusted for sociodemographic characteristics.
- **Supplementary Table 5:** Results from the Poisson regression models for the 6-month mental health and addictions outpatient visit outcomes for incident cases of 1st episode psychosis in Ontario population aged 12-50 years (January 1, 2017–December 31st, 2021), adjusted for sociodemographic characteristics.
- **Supplementary Table 6:** Results from the logistic regression models for 6-month mental health and addictions ED visit and hospitalisation outcomes for incident cases of 1st episode psychosis in Ontario population aged 12-50 years (January 1, 2017–December 31st, 2021), adjusted for sociodemographic characteristics and health service utilisation.
- **Supplementary Table 7:** Results from the Poisson regression models for the 6-month mental health and addictions outpatient visit outcomes for incident cases of 1st episode psychosis in Ontario population aged 12-50 years (January 1, 2017–December 31st, 2021), adjusted for sociodemographic characteristics and health service utilisation.

