



Trends in clients with mental health and/or substance use related healthcare who use Community Health Centres (CHC) in Ontario, Canada: A population-based cohort study

Journal:	<i>CMAJ Open</i>
Manuscript ID	CMAJOpen-2019-0089
Manuscript Type:	Cohort (retrospective)
Date Submitted by the Author:	03-Jun-2019
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More Detailed Keywords:	Community Health Centres, population-based cohort, mental health, substance use
Keywords:	Mental health, Community medicine, Health services research
Abstract:	Background: Community Health Centres (CHC) provide an important avenue for primary healthcare in Ontario, especially for those suffering from mental illness and substance use disorders. Methods: This population-based cohort study examined CHC clients age >21 years who were first time clients between 1 April 2014 and 31 March 2015, with a previously established medical history of mental health and/or substance use disorder in the preceding two-year period. We examined three cohorts: clients who used a (1) CHC site that serve priority populations, or (2) CHC site that serve populations with barriers to care, and (3) Ontarians with a medical history of mental health and/or substance use disorder who were not CHC clients during the same period. Multivariable logistic regression was used to generate the odds of psychiatric care and emergency department usage over a one-year follow-up period. Results: Compared to the Ontarian cohort, clients of CHCs were younger, suffered more residential instability, and possessed an increased prevalence of medical comorbidities and substance use. Urban at risk CHC clients had a 21% (AOR 1.21, 95% CI: 1.16-1.26) and 28% (AOR 1.28, 95% CI: 1.24-1.33) increased odds of receiving care from a psychiatrist or visiting an emergency department, respectively, in the one-year follow-up period. Interpretation: CHC clients who have mental health and/or substance use disorder are medically complex and resource intense users of the health system. Special attention should be paid to this cohort in order to ensure adequate clinical services are provided to

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	support this vulnerable population.

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The RECORD statement – checklist of items, extended from the STROBE statement, that should be reported in observational studies using routinely collected health data.

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported (page)
Title and abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found		RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	1,2 2
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported			4
Objectives	3	State specific objectives, including any prespecified hypotheses			4
Methods					
Study Design	4	Present key elements of study design early in the paper			5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection			5

<p>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27</p> <p>Participants</p>	<p>6</p>	<p>(a) <i>Cohort study</i> - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> - Give the eligibility criteria, and the sources and methods of selection of participants</p> <p>(b) <i>Cohort study</i> - For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> - For matched studies, give matching criteria and the number of controls per case</p>		<p>RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided.</p> <p>RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided.</p> <p>RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.</p>	<p>6-7</p> <p>5-6</p> <p>n/a</p>
<p>28 29 30 31 32 33 34</p> <p>Variables</p>	<p>7</p>	<p>Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.</p>		<p>RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.</p>	<p>Appendix A</p>
<p>35 36 37 38 39 40 41 42</p> <p>Data sources/ measurement</p>	<p>8</p>	<p>For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group</p>			<p>5-6</p>

1 2 3 4	Bias	9	Describe any efforts to address potential sources of bias		6
5 6 7 8 9	Study size	10	Explain how the study size was arrived at		6
10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34	Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why		7-8
35 36 37 38 39 40 41 42 43 44	Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) <i>Cohort study</i> - If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> - If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses		8 8 Tables
45 46 47	Data access and cleaning methods		..	RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population.	5

				RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	n/a
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	5
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (<i>e.g.</i> , numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram		RECORD 13.1: Describe in detail the selection of the persons included in the study (<i>i.e.</i> , study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	6-7
Descriptive data	14	(a) Give characteristics of study participants (<i>e.g.</i> , demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) <i>Cohort study</i> - summarise follow-up time (<i>e.g.</i> , average and total amount)			8-9
					N/a
					n/a
Outcome data	15	<i>Cohort study</i> - Report numbers of outcome events or summary measures over time <i>Case-control study</i> - Report numbers in each exposure			8

		category, or summary measures of exposure <i>Cross-sectional study</i> - Report numbers of outcome events or summary measures			
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period			8-10
Other analyses	17	Report other analyses done— e.g., analyses of subgroups and interactions, and sensitivity analyses			10
Discussion					
Key results	18	Summarise key results with reference to study objectives			10-11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias		RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	11-12
Interpretation	20	Give a cautious overall interpretation of results considering objectives,			10-11

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		limitations, multiplicity of analyses, results from similar studies, and other relevant evidence			
Generalisability	21	Discuss the generalisability (external validity) of the study results			12
Other Information					
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based			14
Accessibility of protocol, raw data, and programming code		..		RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	8, Appendix

*Reference: Benchimol EI, Smeeth L, Guttman A, Harron K, Moher D, Petersen I, Sørensen HT, von Elm E, Langan SM, the RECORD Working Committee. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement. *PLoS Medicine* 2015; in press.

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5 **Trends in clients with mental health and/or substance use related healthcare who use**
6 **Community Health Centres (CHC) in Ontario, Canada: A population-based cohort study**
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35 Number of words: 2360

36 Number of inserts: 4
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ABSTRACT

Background: Community Health Centres (CHC) provide an important avenue for primary healthcare in Ontario, especially for those suffering from mental illness and substance use disorders. Detailed descriptions of CHC clients experiencing these conditions has yet to be undertaken.

Methods: This population-based cohort study examined CHC clients age >21 years who were first time clients between 1 April 2014 and 31 March 2015, with a previously established medical history of mental health and/or substance use disorder in the preceding two-year period. We examined three cohorts: clients who used a (1) CHC site that serve priority populations, or (2) CHC site that serve populations with barriers to care, and (3) Ontarians with a medical history of mental health and/or substance use disorder who were not CHC clients during the same period. Multivariable logistic regression was used to generate the odds of psychiatric care and emergency department usage over a one-year follow-up period.

Results: Compared to the Ontarian cohort, clients of CHCs were younger, suffered more residential instability, and possessed an increased prevalence of medical comorbidities and substance use. Urban at risk CHC clients had a 21% (AOR 1.21, 95% CI: 1.16-1.26) and 28% (AOR 1.28, 95% CI: 1.24-1.33) increased odds of receiving care from a psychiatrist or visiting an emergency department, respectively, in the one-year follow-up period.

Interpretation: CHC clients who have mental health and/or substance use disorder are medically complex and resource intense users of the health system. Special attention should be

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3 paid to this cohort in order to ensure adequate clinical services are provided to support this
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5 vulnerable population.
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INTRODUCTION

Mental illness and substance use disorders are prevalent within the Ontario population, especially in vulnerable and marginalized populations. Due to the ongoing stigma associated with these conditions, societal exclusion and isolation is commonplace,^{1,2} including within primary healthcare (PHC) settings.³ In Ontario, Community Health Centres (CHC) are a PHC model that serves populations who experience barriers to obtaining healthcare (e.g., poverty, geographic isolation, ethno- and culturo-centrism, racism, sexism, heterosexism, transphobia, language discrimination, and other forms of social exclusion).⁴ CHCs provide a comprehensive range of interprofessional healthcare services, including care from physicians, nurse practitioners, nurses, social workers, dietitians, and health promoters.⁵ For over 40 years, CHCs have served over 600,000 people in 110 communities across the province⁶, including large populations of individuals living in lower income neighbourhoods with severe mental illness and chronic health conditions.⁷ While there has been recent population-level examinations of various mental health and substance use outcomes in Ontario,^{8,9} research specific to the CHC client populations has yet to be undertaken. Due to the increasing rates of mental health and addictions in Ontario¹⁰⁻¹³ obtaining a better understanding of CHC clients who use mental illness and/or substance use related healthcare is needed.

The objectives of this study were to identify CHC clients with a history of mental health and/or substance use related healthcare, and describe their demographics, socio-economic background, utilization of healthcare services, and related health risks in comparison to community controls who do not use CHC services.

METHODS

Setting

We conducted a population-based cohort study in Ontario, Canada's most populous province. Ontario has a single-payer, healthcare insurance plan (Ontario Health Insurance Plan [OHIP]) which allows residents to access medically necessary healthcare services through providers and healthcare organizations. Records generated through interaction with the healthcare system thus represent the entire population. The use of data in this project was authorized under section 45 of Ontario's Personal Health Information Protection Act, which does not require review by a Research Ethics Board. Further, this manuscript adheres to the Reporting of studies Conducted by using the Observational Routinely-collected health Data statement.¹⁴

Data Sources

We identified CHC clients using the Community Health Centres dataset, which was extracted from the CHC electronic medical record and deterministically linked to health administrative datasets housed at ICES.¹⁵ Clinical and healthcare utilization was determined using: the Discharge Abstract Database (2011-2016), which contains patient-level hospital admission and discharges; the National Ambulatory Care Reporting System (2011–2016), which contains data related to ambulatory and emergency department utilization; Ontario Mental Health Reporting System (2011-2016), which contains data related to all individuals receiving adult mental health services; and the Ontario Health Insurance Plan (2011-2016) database, which contains physician billing and diagnostic data. In addition to these, certain chronic conditions were identified using ICES derived datasets, applying validated case definitions, including the Ontario Asthma dataset,¹⁶ the Ontario Chronic Obstructive Pulmonary Disease cohort,¹⁷ the

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3 Ontario Diabetes dataset,¹⁸ the Ontario Hypertension dataset,¹⁹ the Ontario Rheumatoid Arthritis
4 dataset,²⁰ the Ontario Crohn's and Colitis cohort²¹ and the Ontario HIV database.²²
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8 Other socio-demographic data used in the study was drawn from the ICES Registered
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10 Persons Database, Immigration, Refugees and Citizenship Canada Permanent Residents database
11 (immigration information), Client Agency Program Enrolment (patients registered to a primary
12 healthcare physician), Ontario Marginalization Index²³ (levels of marginalization across the
13 province), and the Primary Care Population database. These datasets were linked using unique
14 encoded identifiers and analyzed at ICES. ICES is an independent, non-profit research institute
15 whose legal status under Ontario's health information privacy law allows it to collect and
16 analyze health care and demographic data, without consent, for health system evaluation and
17 improvement.
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31 **Study Population**

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33 The CHC group included all individuals aged 21 to 105 who presented for care at a CHC
34 between 1 April 2014 and 31 March 2015 and had a history of mental health and/or substance
35 use related healthcare as indicated through outpatient (CHC or traditional physician visits),
36 emergency department or inpatient diagnostic codes in the preceding two-year period. CHC
37 clients were subdivided into two subgroups: (1) '*urban at risk*' (UR); (2) *non 'urban at risk'*
38 (NUR) CHCs. UR CHCs are defined as CHC sites located in major urban environments which
39 predominantly serve a priority population who are homeless or possess challenges with mental
40 health and substance addictions.¹⁵ NUR CHCs are sites that arise in both urban and rural areas of
41 Ontario and serve populations with barriers to care, but have not been identified as a priority
42 population in terms of homelessness or issues with mental health and substance addictions.¹⁵
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3 As a comparator to the CHC client groups, we identified a reference population of
4 individuals aged 21 to 105 who had a past history of mental health and/or substance use related
5 healthcare in the preceding two-year time and were not CHC clients during the same period.
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11 **Outcome Measure**

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15 Several outcomes occurring within one year after entry into the cohort were assessed
16 descriptively, including: (1) outpatient visits (whether to a PHC physician or a CHC), (2) visits
17 to a subset of specialists (cardiologist, endocrinologist, psychiatrist, or respirologist), (3)
18 emergency department visits, and (4) hospitalizations. Two of these outcomes were further
19 assessed with adjustment for potential confounders: receipt of psychiatrist care and emergency
20 department visit in the follow-up year.
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31 **Variables**

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33 The main variable of interest was group type (UR CHC; NUR CHC; or Ontario
34 community control). A range of other predictors were considered including age, sex, type of
35 mental health or substance use related healthcare used within the past two years, presence of
36 several chronic conditions identified within three years of cohort entry (i.e., asthma, COPD,
37 diabetes, hypertension, infective endocarditis, rheumatoid arthritis, congestive heart failure,
38 chronic liver disease, chronic kidney disease, Crohn's / Ulcerative Colitis, HIV) and presence of
39 chronic pain or skin and soft tissue infection within the past year. In addition, neighbourhood
40 level income quintiles and the Ontario Marginalization Index^{23,24} were used to show
41 marginalisation and area-level inequalities, using 2006 census data. We also identified whether
42 individuals were rostered to a family physician at their cohort entry date, since in Ontario clients
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3 can be registered at a CHC and with another PHC model simultaneously.⁷ Predictor and outcome
4 variables including, where applicable, standardized diagnosis and fee codes are available in
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6 Supplement Appendix 1.
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10 11 12 **Data Analysis**

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14 We compared baseline characteristics between groups using one-way ANOVAs and chi-
15 squared tests as appropriate. P-values of less than 5% were considered significant. We then
16 compared unadjusted outcomes between groups using the same statistical tests. Finally, we
17 applied multivariable logistic regression for two outcomes: receipt of healthcare from a
18 psychiatrist and emergency room utilization over a one-year follow-up. Adjusted odds ratios
19 were calculated with 95% confidence intervals. All analyses were conducted using SAS version
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33 **RESULTS**

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35 After exclusions, the cohort included 21,783 CHC clients (6,575 UR and 15,208 NUR)
36 and 1,673,200 community controls (Figure 1) with a history of mental health and/or substance
37 use related healthcare. Roughly 16% of the community controls had a history of mental health
38 related healthcare and/or substance use, compared to 27% and 14% of UR and NUR clients,
39 respectively.
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47 Table 1 shows that the three cohorts have distinct demographic, comorbid and healthcare
48 usage profiles. UR CHC clients were generally younger and more likely to be male compared to
49 the NUR CHC clients and community controls. UR CHCs also served more clients residing in
50 areas of lower income and greater material deprivation, residential instability, and dependency
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3 compared to NUR CHCs and especially community controls. Further, UR clients had higher
4 rates of health care utilization for psychotic disorders when contrasted against NUR and
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6 substantively for the community controls; UR CHC clients also had higher rates of health care
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8 utilization related to substance use compared to the NUR CHC clients and community controls.
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10 UR CHC clients had higher rates of chronic liver disease and skin and soft tissue infections
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12 compared to the NUR CHCs and Ontario populations.
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17 NUR CHC clients were generally female, rural, more middle-incomed, and the least
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19 likely to be rostered to a PHC physician practice compared to either UR and especially the
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21 community controls. Clients of NUR CHCs also possessed comparable rates of healthcare
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23 utilization for non-psychotic disorders when contrasted against UR and community controls.
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25 Finally, NUR CHC clients possessed comparable rates of congestive heart failure, hypertension,
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27 and Crohn's/Ulcerative Colitis with community controls, which were higher than those observed
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29 in UR CHC clients.
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33 One-year unadjusted outcomes are presented in Table 2. Overall, UR CHC clients had a
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35 higher number of outpatient PHC visits compared to the NUR CHCs and community controls.
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37 Psychiatrist and Respirologist visits were similar between UR CHC clients and NUR, and
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39 significantly higher than community controls. UR CHC clients had higher rates of Cardiologist
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41 and emergency department visits than NUR and the community control. NUR CHC clients had
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43 increased visits to Endocrinologists compared to UR and community controls.
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47 Adjusted odds ratios (AOR) for two logistic regressions are presented in Table 3. We
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49 found that the odds of an UR CHC client receiving care from a psychiatrist or visiting an
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51 emergency department in the year after first interaction with a CHC was 21% (AOR 1.21, 95%
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53 CI: 1.16-1.26) and 28% (AOR 1.28, 95% CI: 1.24-1.33) higher compared to community controls.
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3 Further, NUR CHC clients' odds of receiving psychiatrist care in the following year was 59%
4 (AOR 1.59, 95% CI: 1.53-1.64) higher than community controls. NUR CHC clients' odds of
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6 visiting an emergency department in the year following interaction with the CHC was
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8 comparable to the general population (AOR 1.03, 95% CI: 1.00-1.06).
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11 **INTERPRETATION**

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14 This population-based study examined characteristics and health care utilization for a
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16 unique cohort of people with mental health and/or substance use related healthcare history seen
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18 by UR and NUR CHCs. These findings, in conjunction with the reported descriptive statistics,
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20 paint a deeper picture of the complexity of both UR and NUR CHC clients who have mental
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22 health and/or substance use related healthcare. It would appear that both UR and NUR CHC
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24 clients have higher rates of mental health and/or substance use than community controls. Further,
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26 UR and NUR CHC clients are generally younger, poorer, and have increased levels of material
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28 deprivation, residential instability, and comorbidity complexity when contrasted against the
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30 Ontario population. Not surprisingly, both UR and NUR CHC clients are also more intense users
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32 of clinical specialists, the emergency department, and hospitalization. Drawn together, these
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34 findings suggest that CHC clients with mental health and/or substance use related healthcare
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36 history are likely more medically complex and vulnerable than the average Ontarian who has a
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38 mental health and/or substance use disorder.
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45 The striking differences between the clinical complexity of CHC clients in comparison to
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47 a representative Ontario cohort is consistent with other research in this area.^{7,15} Previous research
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49 exploring residential instability has suggested that lack of stable housing can influence health
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51 status in significant ways.²⁶⁻²⁸ For instance, the UR CHC clients appear to be younger, with
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53 higher portions of residential instability and material deprivation than NUR CHC clients and
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3 especially the community controls. Consistent with other research examining community-based
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5 vulnerable populations, we also found CHC clients with mental health and/or substance use were
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7 more likely to use an emergency department resources,^{29,30} obtain specialist healthcare
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9 services,³¹ possess high levels of medical comorbidities,³² and be less likely rostered to a family
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11 physician.³² Due to both the higher levels of residential instability and health system utilization
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13 of UR and NUR CHC clients in comparison to the community controls, further work should be
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15 placed upon growing housing services and models of care that can support the complex needs of
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17 these clients.
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21 Finally, as a cohort of the Ontarian population that does not appear to be well rostered to
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23 traditional physician-based PHC services, there is a possibility that CHC clients have been under
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25 represented in previous population-level examinations of PHC utilization drawn from healthcare
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27 administrative data in the province of Ontario. Due to the relatively recent addition of the CHC
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29 database to ICES,¹⁵ this study represents the first attempt to contextualize the baseline
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31 characteristics and healthcare utilization of CHC clients in terms of mental health and/or
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33 substance use related healthcare. Through analysis, it has become evident that clients of both UR
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35 and NUR CHCs are more medically complex and exist with higher levels of material deprivation
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37 and residential instability than a comparable Ontario cohort.
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44 **LIMITATIONS**

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46 This study is not without limitations. The study is a non-randomized retrospective
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48 examination of both CHC clients and a cohort of people who also possessed a mental health
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50 and/or substance use disorder diagnosis in the province of Ontario. While it would have been
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52 possible to examine individuals with either a mental health or substance use disorder in isolation
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3 of each other, given the high prevalence of both diagnoses occurring concurrently in this
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5 population, the two potential groups were collapsed into one group. Further work is required to
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7 more specifically examine the trends and prevalence of co-occurring mental health and substance
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9 use disorder diagnoses within CHC populations.
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12 This study is also subject to numerous confounders present in society. While were we
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14 able to account for various covariates including material deprivation, elements of multimorbidity,
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16 and other past health system interaction, drawing causal inferences from this study should be
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18 avoided. We were unable to account for a range of determinant of health variables including
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20 housing, education, and other physical environmental factors that can have significant influence
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22 on health.³³
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28 **CONCLUSION**

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30 CHC clients who have a diagnosis of mental health and/or substance use disorder are
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32 younger, have higher levels of material deprivation, are more medically complex, and possess
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34 higher odds of using emergency department and specialized psychiatric services than other
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36 Ontarians with similar diagnoses. As intense users of healthcare resources, CHC clients with
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38 mental health and/or substance use related healthcare need to be further examined in order to
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40 generate more specific interventions that can be used to better serve this vulnerable population.
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42 As outlined in this study, it would appear that the majority of CHC clients who have mental
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44 health and/or substance use issues rely heavily upon the CHCs as their primary avenue for PHC
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46 services in the province. This finding, along with the healthcare complexities faced by this
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48 demographic, have important policy and practice implications for database research to ensure
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50 CHC clients are adequately represented in future PHC research derived from population-level
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Contributions:

Richard Booth and Jennifer Rayner led the study. All authors contributed to the study design, analysis, and drafting of the manuscript. All authors have given final approval for the manuscript to be published and agreed to act as guarantors of the work.

Funding:

This study was also supported through funding provided by the Faculty of Health Sciences (Western University)(RB); Lawson Health Research Institute, IRF grant (F0598)(RB); Ontario Trillium Foundation (JR/RB); the Ontario Ministry of Research, Innovation and Science — Early Researcher Award (2017-2022)(RB); and ICES Western.

Acknowledgements

This study was supported by the ICES Western site. ICES is funded by an annual grant from the Ontario Ministry of Health and Long-Term Care (MOHLTC). Core funding for ICES Western is provided by the Academic Medical Organization of Southwestern Ontario (AMOSO), the Schulich School of Medicine and Dentistry (SSMD), Western University, and the Lawson Health Research Institute (LHRI). Parts of this material are based on data and/or information compiled and provided by CIHI and Cancer Care Ontario (CCO). However, the analyses, conclusions, opinions and statements expressed in the material are those of the author(s), and not necessarily those of CIHI or CCO. Immigration data was provided by Immigration, Refugees and Citizenship Canada. We thank IMS Brogan Inc. for use of their Drug Information Database. The opinions, results and conclusions are those of the authors and are independent from the funding sources. No endorsement by ICES, AMOSO, SSMD, LHRI, CIHI, CCO, or the MOHLTC is intended or should be inferred.

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Table 1. Characteristics of the cohort subgroups at baseline

	Urban at risk CHC (n=6,575)	Non urban at risk CHC (n=15,208)	Ontario (n=1,673,200)	P-value
Sex=Female, n (%)	3,293 (50.1)	9,050 (59.5)	978,646 (58.5)	
Age Group, n (%)				
21-35 years	1,656 (25.2)	3,712 (24.4)	361,560 (21.6)	< 0.001
35-49 years	2,240 (34.1)	4,373 (28.8)	477,381 (28.5)	
50-64 years	2,212 (33.6)	5,016 (33.0)	502,974 (30.1)	
65 years or older	467 (7.1)	2,107 (13.9)	331,285 (19.8)	
Income Quintiles ¹ , n (%)				
Quintile 1 (lowest)	3,030 (46.1)	6,049 (39.8)	346,854 (20.7)	< 0.001
Quintile 2	1,367 (20.8)	3,258 (21.4)	330,170 (19.7)	
Quintile 3	961 (14.6)	2,362 (15.5)	326,318 (19.5)	
Quintile 4	687 (10.4)	1,960 (12.9)	340,802 (20.4)	
Quintile 5 (highest)	448 (6.8)	1,495 (9.8)	318,302 (19.0)	
Residential Instability ¹ , n (%)				
Quintile 1 (lowest)	218 (3.3)	1,284 (8.4)	300,967 (18.0)	< 0.001
Quintile 2	373 (5.7)	1,715 (11.3)	293,752 (17.6)	
Quintile 3	611 (9.3)	2,526 (16.6)	296,501 (17.7)	
Quintile 4	1,328 (20.2)	3,528 (23.2)	325,170 (19.4)	
Quintile 5 (highest)	3,960 (60.2)	5,980 (39.3)	443,292 (26.5)	
Material Deprivation ¹ , n (%)				
Quintile 1 (lowest)	337 (5.1)	1,278 (8.4)	278,032 (16.6)	< 0.001
Quintile 2	494 (7.5)	1,828 (12.0)	307,538 (18.4)	
Quintile 3	795 (12.1)	2,528 (16.6)	319,847 (19.1)	
Quintile 4	1,354 (20.6)	2,838 (18.7)	341,218 (20.4)	
Quintile 5 (highest)	3,510 (53.4)	6,561 (43.1)	413,047 (24.7)	
Dependency ¹ , n (%)				
Quintile 1 (lowest)	1,533 (23.3)	2,890 (19.0)	416,126 (24.9)	< 0.001
Quintile 2	1,477 (22.5)	2,660 (17.5)	325,971 (19.5)	
Quintile 3	1,250 (19.0)	2,878 (18.9)	299,413 (17.9)	
Quintile 4	1,069 (16.3)	3,068 (20.2)	283,751 (17.0)	
Quintile 5 (highest)	1,161 (17.7)	3,537 (23.3)	334,421 (20)	

Ethnic Concentration ¹ , n (%)				
Quintile 1 (lowest)	1,101 (16.7)	4,076 (26.8)	257,281 (15.4)	
Quintile 2	1,227 (18.7)	2,679 (17.6)	285,263 (17.0)	
Quintile 3	1,089 (16.6)	2,032 (13.4)	320,477 (19.2)	< 0.001
Quintile 4	1,727 (26.3)	3,034 (20.0)	366,559 (21.9)	
Quintile 5 (highest)	1,346 (20.5)	3,212 (21.1)	430,102 (25.7)	
Recent Immigrant Status, n (%)				
	148 (2.3)	560 (3.7)	65,024 (3.9)	< 0.001
Rural, n (%)				
	214 (3.3)	2958 (19.5)	164,704 (9.8)	< 0.001
Rostered to a Family Physician, n (%)				
	2,029 (30.9)	4,467 (29.4)	1,368,951 (81.8)	< 0.001
Mental Health Related Care (within 2 years)				
Psychotic Disorder	1,596 (24.3)	3,587 (23.6)	180,503 (10.8)	< 0.001
Non-Psychotic Disorder	3,680 (56.0)	8,011 (52.7)	934,312 (55.8)	< 0.001
Substance use Disorder	2,832 (43.1)	3,250 (21.4)	182,173 (10.9)	< 0.001
Other Mental Health	1,234 (18.8)	2,359 (15.5)	238,961 (14.3)	< 0.001
Co-morbidities (within 3 years)				
Asthma	1,700 (25.9)	3,765 (24.8)	313,695 (18.7)	< 0.001
COPD	1,360 (20.7)	3,026 (19.9)	204,227 (12.2)	< 0.001
Diabetes	1,073 (16.3)	2,815 (18.5)	249,948 (14.9)	< 0.001
Hypertension	1,738 (26.4)	4,973 (32.7)	541,200 (32.0)	< 0.001
Infective Endocarditis	48 (0.7)	21 (0.1)	1,089 (0.1)	< 0.001
Rheumatoid Arthritis	55 (0.8)	116 (0.8)	4,985 (0.3)	< 0.001
Congestive Heart Failure	146 (2.2)	455 (3.0)	45,813 (2.7)	0.006
Chronic Liver Disease	1,394 (21.2)	1,400 (9.2)	65,287 (3.9)	< 0.001
Chronic Kidney Disease	459 (7.0)	1,183 (7.8)	82,278 (4.9)	< 0.001
Crohn's Ulcerative Colitis	51 (0.8)	163 (1.1)	18,461 (1.1)	< 0.001
HIV	23 (0.3)	21 (0.1)	758 (0)	< 0.001
Co-morbidities (within 1 year)				
Skin and Soft Tissue Infection	1,094 (16.6)	1,742 (11.5)	105,782 (6.3)	< 0.001
Chronic Pain	1,690 (25.7)	3,783 (24.9)	224,204 (13.4)	< 0.001

¹Missing data not included in table – percentages may not total 100%;

CHC: Community Health Centre; Residential Instability, Material Deprivation, Dependency, Ethnic Concentration drawn from Ontario Marginalization Index (ONMarg);

Psychotic Disorder, Non-psychotic disorder, Substance use Disorder, and Other Mental Health includes any hospitalization or 2 claims in 2 years or less of any eligible diagnostic

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or fee code (see Supplement), within 2 years prior to index date; Recent Immigrant Status: Presence in IRCC database with landing date less than 10 years before index date;
Rural: resides in a settlement of <10,000 individuals; COPD: chronic obstructive pulmonary disease; HIV: human immunodeficiency virus

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Table 2. One-year follow-up unadjusted outcomes

	Urban at risk CHC (n=6,575)	Non urban at risk CHC (n=15,208)	Ontario (n=1,673,200)	P-value
Specialist visit within 1 year (n, %)				
Psychiatrist	2,514 (38.2)	5,891 (38.8)	265,417 (16.1)	< 0.001
Respirologist	624 (9.5)	1,399 (9.2)	67,295 (4.1)	< 0.001
Endocrinologist	270 (4.1)	1,016 (6.7)	60,415 (3.7)	< 0.001
Cardiologist	2,262 (34.4)	3,750 (24.7)	117,933 (7.2)	< 0.001
Primary healthcare visits, mean (SD)	34.4 (37.6)	25.5 (28.3)	16.5 (21.4)	< 0.001
Emergency Department visits, mean (SD)	2.6 (7.0)	1.5 (4.1)	0.7 (1.9)	< 0.001
Hospitalizations, mean (SD)	0.26 (0.9)	0.2 (0.7)	0.11 (0.5)	< 0.001

CHC: Community Health Centre; SD: standard deviation

Table 3. Adjusted odds ratio (AOR) during follow-up period

	AOR of psychiatric care during follow-up (1 year) ¹	AOR of emergency department visit during follow-up (1 year) ²
Type of CHC (reference=Ontario cohort)		
Urban Risk CHC	1.21 (1.16-1.26)*	1.28 (1.24-1.33)*
Non-Urban Risk CHC	1.59 (1.53-1.64)*	1.03 (1.00-1.06)
Age at cohort entry, per year increase	0.99 (0.99-0.99)*	1.00 (0.99-1.00)*
Sex (reference=female)	1.03 (1.03-1.04)*	0.92 (0.92-0.93)*
Income Quintile (reference=Quintile 1)		
Quintile 2	0.97 (0.96-0.98)*	1.01 (1.00-1.01)
Quintile 3	0.97 (0.96-0.98)*	1.01 (1.00-1.01)
Quintile 4	0.99 (0.98-1.00)	0.99 (0.98-1.00)*
Quintile 5 (highest)	1.14 (1.13-1.15)*	0.93 (0.92-0.94)*
Residential Instability (reference=Quintile 1)		
Quintile 2	0.93 (0.92-0.94)*	0.99 (0.98-1.00)
Quintile 3	0.98 (0.97-0.99)*	1.01 (1.00-1.01)
Quintile 4	1.06 (1.05-1.07)*	1.02 (1.02-1.03)*
Quintile 5 (most)	1.18 (1.17-1.19)*	1.03 (1.03-1.04)*
Material Deprivation (reference=Quintile 1)		
Quintile 2	1.0 (0.99-1.01)	0.94 (0.94-0.95)*
Quintile 3	1.01 (1.00-1.02)	1.00 (0.99-1.00)
Quintile 4	0.98 (0.97-0.99)*	1.05 (1.05-1.06)*
Quintile 5 (most)	1.00 (0.99-1.01)	1.15 (1.14-1.16)*
Dependency (reference=Quintile 1)		
Quintile 2	1.02 (1.01-1.03)*	0.96 (0.95-0.97)*
Quintile 3	1.04 (1.03-1.05)*	0.99 (0.98-1.00)
Quintile 4	1.02 (1.01-1.03)*	1.03 (1.02-1.04)*
Quintile 5 (most)	0.98 (0.97-0.99)*	1.04 (1.04-1.05)*
Ethnic Concentration (reference=Quintile 1)		
Quintile 2	0.84 (0.83-0.85)*	1.16 (1.15-1.16)*
Quintile 3	0.98 (0.97-0.99)*	1.01 (1.00-1.02)*
Quintile 4	1.17 (1.16-1.18)*	0.89 (0.88-0.89)*
Quintile 5 (most)	1.26 (1.25-1.28)*	0.80 (0.79-0.81)*
Recent Immigrant Status (reference='no')	0.88 (0.87-0.89)*	0.94 (0.93-0.95)*
Rural (reference='urban')	0.88 (0.87-0.89)*	1.20 (1.19-1.21)*
Rostered to a family physician (reference= Rostered)		
Virtually Rostered	0.97 (0.96-0.98)*	1.04 (1.03-1.05)*
Not Rostered	1.08 (1.07-1.09)*	0.98 (0.98-0.99)*
Healthcare related to:		
Non-Psychotic Disorder (reference= no)	1.83 (1.82-1.84)*	1.10 (1.10-1.11)*
Psychotic Disorder (reference= no)	2.45 (2.44-2.47)*	1.13 (1.13-1.14)*
Substance use Disorder (reference= no)	0.98 (0.97-0.99)*	1.30 (1.30-1.31)*

Co-morbidities (reference= no)		
Asthma		1.14 (1.13-1.14)*
COPD		1.13 (1.13-1.14)*
Diabetes		1.11 (1.10-1.11)*
Hypertension		1.11 (1.10-1.11)*
Rheumatoid Arthritis		1.12 (1.09-1.15)*
Congestive Heart Failure		1.33 (1.31-1.34)*
Chronic Liver Disease		1.10 (1.09-1.11)*
Chronic Kidney Disease		1.35 (1.34-1.36)*
Crohn's/Ulcerative Colitis		1.18 (1.17-1.20)*
HIV		1.18 (1.10-1.28)*
Skin/Soft Tissue Infections (within 1 year)		1.27 (1.27-1.28)*
Chronic Pain (within 1 year)		1.23 (1.22-1.24)*

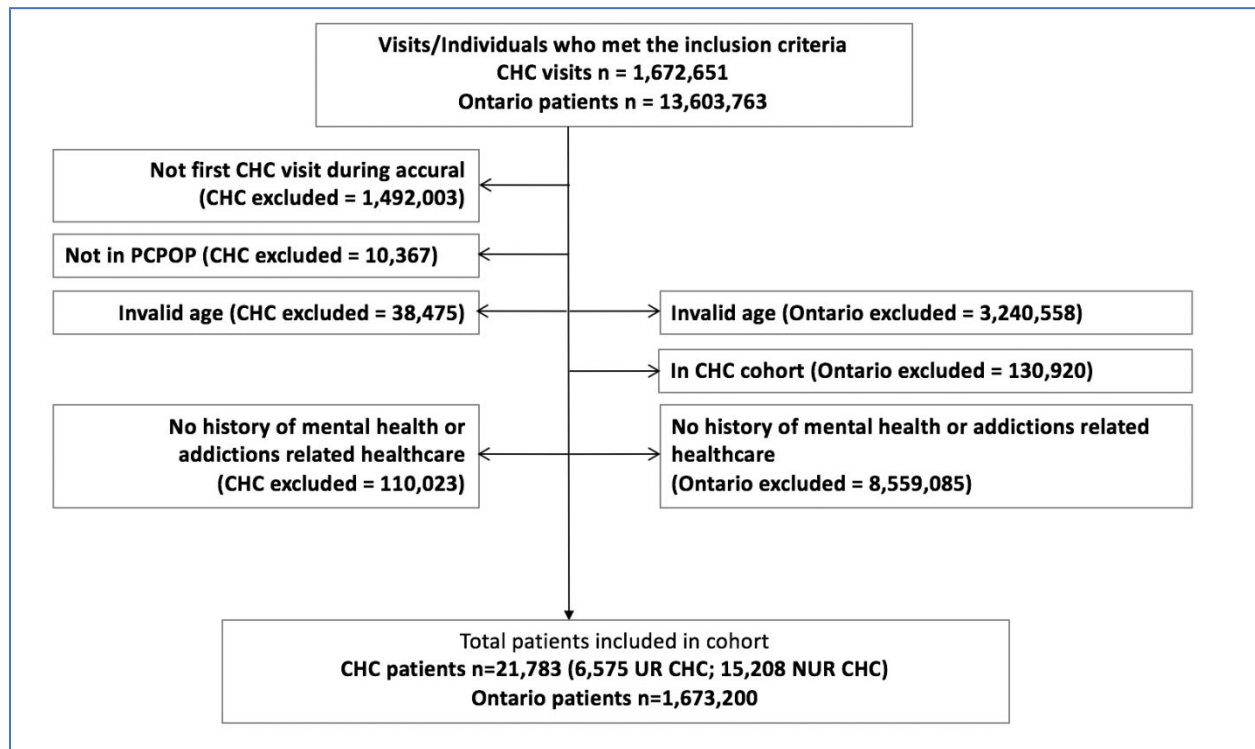
* < 0.001

AOR: Adjusted odds ratio; CHC: Community Health Centre; No.: number; Residential Instability, Material Deprivation, Dependency, Ethnic Concentration drawn from ONMarg; Recent Immigrant Status: Presence in IRCC database with landing date less than 10 years before index date; Rural: resides in a rural area as defined as a settlement of <10,000 individuals; Psychotic Disorder, Non-psychotic disorder, Substance use Disorder includes any hospitalization or 2 claims in 2 years or less of any related diagnostic or fee code; COPD: chronic obstructive pulmonary disease; HIV: human immunodeficiency virus.

¹Variables adjusted for in psychiatric care model: age, sex, income quintile, resident instability, material deprivation, dependency, ethnic concentration, recent immigrant status, rural, mental health-related healthcare, CHC usage in 3 years, rostered to family physician at index.

²Variables adjusted for in emergency department visit model: age, sex, income quintile, resident instability, material deprivation, dependency, ethnic concentration, recent immigrant status, rural, mental health-related healthcare, CHC usage in 3 years, rostered to family physician at index, comorbidities in last 3 years (ie, Asthma, COPD, Diabetes, Hypertension, Infective Endocarditis, Rheumatoid Arthritis, Congestive heart failure, Chronic Liver Disease, Chronic Kidney Disease, Crohn's/Ulcerative Colitis, HIV), comorbidities in last year (ie, Skin and Soft Tissue Infections, Chronic Pain)

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37 UR: urban at risk; NUR: non urban at risk; CHC: Community Health Centre; PCPOP: Primary Care Population dataset
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Supplement Appendix 1

Variable	Data Source	Definition Description and/or Dx/fee Codes
Age	RPDB PCPOP	Age of the individual at the index date
Sex	RPDB	Sex of individual
History of substance use related care	DAD NACRS OMHRS OHIP	1 hospitalization or 2 claims in 2 years or less of any code in variable “Substance use disorder”
History of mental health related care	DAD NACRS OMHRS OHIP	1 hospitalization OR 2 claims in 2 years or less of any code in variable “Psychotic disorder” or “Non-psychotic” or “Other mental health”
Urban at Risk (UR) CHC and Non urban at risk(NUR) CHC	CHC	Presented to a CHC, between 1 April 2014 and 31 March 2015; two subgroups, UR and NUR, developed with CHCV geographic identifier variable
Ontario	PCPOP	In ICES-derived Primary Care Population dataset, alive as of 1 April 2014
Income quintile	RPDB PCPOP	Neighbourhood income quintile
Residential Instability	ONMarg	Area-level concentrations of people who experience high rates of family or housing instability
Material Deprivation	ONMarg	A combined measure of income, quality of housing, educational attainment, and family structure characteristics
Dependency	ONMarg	Area-level concentrations of people who do not have income from employment
Ethnic Concentration	ONMarg	Concentrations of recent immigrants and people belonging to a ‘visible minority’ group
Recent Immigrant Status	IRCC (CIC)	Presence in IRCC database with landing date less than 10 years before index date
Rural status	RPDB	Resides in a rural area as defined as a settlement of <10,000 individuals
Rostered to a Family Physician at index	CAPE	Rostering to a family physician practice
Psychotic disorder	DAD NACRS OMHRS OHIP	ICD-10: F20, F22, F23, F24, F25, F28, F29, F323, F333; OHIP: 295, 297, 298, 295, 296, 297, 298

Variable	Data Source	Definition Description and/or Dx/fee Codes
Non-psychotic disorder	DAD NACRS OMHRS OHIP	ICD-10: F21, F30, F31, F321, F322, F328, F330, F331, F332, F334, F338, F339, F348, F349, F380, F381, F388, F39, F40, F41, F42, F43, F48, F60, F93; OHIP: 296, 300, 301, 302, 306, 309, 311
Substance use disorder	DAD NACRS OMHRS OHIP	ICD-10: F10, F11, F12, F13, F14, F15, F16, F17, F18, F19, F55, E244, G312, G620, G621, G720, G721, I426, I427, K292, K70, K852, K853, K860, T51, X45, Z502, Z503; OHIP: 291, 292, 303, 304, 305, A680, C680, K680, K682, K683, K684, K701
Other mental health	DAD NACRS OMHRS OHIP	ICD-10: F44, F45, F50, F5, F52, F53, F54, F55, F59, F61, F62, F63, F64, F65, F66, F68, F69, F70, F71, F72, F73, F78, F79, F80, F81, F82, F83, F84, F88, F89, F90, F91, F92, F94, F95, F98, F99, X60, X61, X62, X63, X64, X65, X66, X67, X68, X69, X70, X71, X72, X73, X74, X75, X76, X77, X78, X79, X80, X81, X82, X83, X84
Asthma	PCPOP ASTHMA	Presence in the database indicates the individual has a history of asthma
COPD	PCPOP COPD	Presence in the database indicates the individual has a history of COPD
Diabetes	PCPOP ODD	Presence in the database indicates the individual has a history of diabetes
Hypertension	PCPOP HYPER	Presence in the database indicates the individual has a history of hypertension
Infective Endocarditis	DAD	ICD-10: I330, I339
Rheumatoid Arthritis	ORAD	Presence in the database indicates the individual has a history of rheumatoid arthritis
Congestive heart failure	CHF	Presence in the database indicates the individual has a history of congestive heart failure
Chronic Liver Disease	DAD NACRS	ICD-10: B16, B17, B18, B19, I85, R17, R18, R160, R162, B942, Z225, E831, E830, K70, K713, K714, K715, K717, K721, K729, K73, K74, K753, K754, K758, K759, K76, K77; OHIP: 571, 573, 070, Z551, Z554
Chronic Kidney Disease	DAD NACRS	ICD-10: E102, E112, E132, E142, I12, I13, N00, N01, N02, N03, N04, N05, N06, N07, N08, N10, N11, N12, N13, N14, N15, N16, N17, N18, N19, N20, N21, N22, N23; OHIP: 403, 585
Crohn's Ulcerative Colitis	OCCC	Presence in the database indicates the individual has a history of Crohn's / Ulcerative Colitis
HIV	HIV	Presence in the database indicates the individual has a history of HIV

Variable	Data Source	Definition Description and/or Dx/fee Codes
Skin and Soft Tissue Infection	DAD SDS NACRS OHIP	ICD-10: A46, B86, H00, H031, H600, H601, H602, H603, H620, H622, H623, H66, J340, J340, K122, K61, L00, L01, L02, L03, L04, L05, L08; OHIP: 035, 680, 682, 683, 684, 685, 686
Chronic Pain	DAD SDS NACRS OHIP	ICD-10: F454, M081, M2550, M2551, M2555, M2556, M2557, M432, M433, M434, M435, M436, M45, M461, M463, M464, M469, M47, M480, M481, M488, M489, M508, M509, M51, M531, M532, M533, M538, M539, M54, M608, M609, M633, M790, M791, M792, M796, M797, M961; OHIP: 720, 721, 722, 724, 729
Primary healthcare visits	OHIP CHC	Number of physician visits within 1 year after to the index date, defined as one visit per day per physician
Emergency department visits	PCPOP NACRS	Number of ED visits within 1 year after to the index date
Hospitalizations	DAD	Number of admissions to acute care hospitals within 1 year after to the index date
Specialist visit Psychiatrist Respirologist Endocrinologist Cardiologist	PCPOP OHIP	Number of specialist visits within 1 year prior to the index date, defined as one visit per day per physician; PCPOP: SV_CARDIO = cardiologist, SV_ENDO = endocrinologist, SV_RESP=respirologist, SV_PSYCH=psychiatrist; OHIP: 2113 (Psychiatrist), 260 (Respirologist), 187 (Endocrinologist), 606 (Cardiologist)