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Examining the relationship between neighbourhood deprivation and mental health service use of immigrants in Ontario, Canada: a cross-sectional study

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ABSTRACT

Objective: While newcomers are often disproportionately concentrated in disadvantaged areas, little attention is given to the effects of immigrants' postimmigration context on their mental health and care use. Intersectionality theory suggests that understanding the full impact of disadvantage requires considering the effects of interacting factors. This study assessed the inter-relationship between recent immigration status, living in deprived areas and service use for non-psychotic mental health disorders.

Study design: Matched population-based cross-sectional study.

Setting: Ontario, Canada, where healthcare use data for 1999–2012 were linked to immigration data and area-based material deprivation scores.

Participants: Immigrants in urban Ontario, and their age-matched and sex-matched long-term residents (a group of Canadian-born or long-term immigrants, n=501 417 pairs).

Primary and secondary outcome measures: For immigrants and matched long-term residents, contact with primary care, psychiatric care and hospital care (emergency department visits or inpatient admissions) for non-psychotic mental health disorders was followed for 5 years and examined using conditional logistic regression models. Intersectionality was investigated by including a material deprivation quintile by immigrant status (immigrant vs long-term resident) interaction.

Results: Recent immigrants in urban Ontario were more likely than long-term residents to live in most deprived quintiles (immigrants—males: 22.8%, females: 22.3%; long-term residents—both sexes: 13.1%, p<0.001). Living in more deprived circumstances was associated with greater use of mental health services, but increases were smaller for immigrants than for long-term residents. Immigrants used less mental health services than long-term residents.

Conclusions: This study adds to existing research by suggesting that immigrant status and deprivation have a combined effect on recent immigrants' care use for non-psychotic mental health disorders. In settings where immigrants are over-represented in deprived

Strengths and limitations of this study

- The main strength of this population-based study is that it used linked administrative databases to examine the inter-relationship between disadvantage, immigration and service use. Results indicate that while disadvantage and immigration each appear to affect mental health service use separately, they also have a combined effect that is complex. This is the first investigation of the relationship between deprivation and mental healthcare use for immigrants who are often over-represented in deprived areas.
- The study is limited by the absence of information on mental health needs which limited the authors' conclusions regarding potential drivers of these findings.
- Another limitation is that non-insured mental health supports were not included.

areas, policymakers focused on increasing immigrants' access of mental health services should broadly address the influence of structural and cultural factors beyond the disadvantage.

INTRODUCTION

People are moving across the globe in larger numbers, faster and farther than at any other time in history.[1] The postimmigration experience can have implications for newcomers' mental health since it has been linked to distinct stressors, such as leaving behind family, creating new social networks and finding sustained appropriate employment.[2–4] Mental health disorders are among the most common and disabling health conditions worldwide. Two such disorders, anxiety disorders and unipolar depression, are estimated to affect 61.5 million and 30.3 million people,

respectively.[5] Consequently, the first few years after arrival are an important time for the host country to support newcomers' access to needed supports, including mental healthcare.[6] Despite this importance, there are concerns that many countries are ill-prepared to deal with changing demographics, and suggestions that knowledge gaps and shortcomings in immigrant resettlement policy could jeopardise immigrants' mental health.[1 3]

Immigrants face a myriad of stressors that can affect postimmigration mental health and access to care (eg, limited fluency in host country language, unfamiliarity with available services, beliefs about illness and treatment that diverge from the host culture, etc). Economic disadvantage is at the forefront of these challenges as recent immigrants are internationally often over-represented in deprived areas. This has been shown using varied indicators of deprivation, including low income[7–10] (USA[11–13]) and ability to afford amenities like food (Germany, Luxembourg).[14–16] In Canada, there are reports of an increasing earnings gap between recent immigrants and non-immigrants over the past two decades.[17] Economic disadvantage can also serve as a barrier to accessing mental healthcare.[7–13]

Findings on the relationship between disadvantage and mental health service use for non-psychotic mental health disorders have not been entirely consistent even when studies were conducted in publically funded systems, where patients experience fewer financial barriers to the use of mental health services.[18] Studies on outpatient mental healthcare that measured deprivation at the individual level or the neighbourhood level have had mixed findings, reporting negative associations[19–21] or no association.[22 23] For inpatient mental healthcare, studies on individual-level and area-level measures of socioeconomic deprivation mostly showed a positive relationship with likelihood of admission.[19 24 25] However, one dated study reported no such relationship.[26] None of these studies specifically examined immigrants contributing to a persisting knowledge gap surrounding the relationship between immigration status, disadvantage and mental health service use.

Examining the postimmigration settlement context can be complicated since being an immigrant and living in poverty are both significant social roles that can interact to influence mental health and mental healthcare use. Intersectionality theory[27 28] argues that social disadvantage arises from intersecting social statuses (eg, recent newcomer, poverty), and that understanding the impact of social disadvantage should consider the combined effects of interacting factors rather than the effects of separate individual factors. In understanding immigrant service use postmigration, this theory supports the value of assessing the combined effect of two important factors which can inform the policy that aims to increase access to care for immigrants. The aim of the present study is to assess the relationship between recent immigration, material deprivation (MD) and mental health service use.

METHODS

This population-based cross-sectional study used administrative data accessed through comprehensive research agreements between Institute for Clinical Evaluative Sciences (ICES) and Ontario's Ministry of Health and Long-Term Care, and between ICES and Citizenship and Immigration Canada (CIC). Data sets were linked using unique, encoded identifiers and analysed at ICES. Analyses were performed using SAS V.9.3 (SAS Institute Inc., Cary, North Carolina, USA).

This study was conducted in Ontario, a Canadian province with a single payer universal healthcare plan which insures outpatient physician services and services delivered in hospital settings without user fees, copayments or deductibles for all permanent residents.[29] Population-level health and immigration databases were linked to examine mental health service use patterns among immigrants and a comparator group of long-term residents (LTRs) that consists largely of non-immigrants.

Data sources

Several databases were accessed for this study and were linked in an anonymous fashion using encrypted individual identifiers. The Ontario portion of the CIC database contains individual-level demographic information recorded on the date of issue for Ontario's permanent residents who landed from 1985 to 2010. In this study it helped identify immigrants who arrived from 1999 to 2007. The Registered Persons Database (RPDB) is Ontario's healthcare registry, and includes birth date, sex and postal code of all Ontario residents eligible for the province's single and universal Ontario Health Insurance Plan (OHIP). An initial validation study[30] of the linkage between the Ontario CIC and RPDB reported that 84.4% of records were successfully linked. The OHIP claims database from 1999 to 2012 was the source of outpatient visit data and the OHIP specialty code used to distinguish outpatient visits as either primary care or psychiatry visits. Hospital admissions were determined from the Canadian Institute for Health Information's Discharge Abstract Database (1981–present) and the Ontario Mental Health Reporting System (2005/2006–present). Emergency department (ED) visits were determined using the National Ambulatory Care Reporting System from 2002 onwards. ED-use data for 1999–2001 was ascertained from the location variable in OHIP claims data. Residence data from the 1996 and 2001 censuses, and Statistics Canada's Postal Code Conversion File were used to link patients' first postal code after arrival (see supplementary appendix B) to urban or rural residences, and to link individuals to MD scores.

Study populations

The eligible study sample included 1 618 672 immigrants listed in the Ontario CIC who arrived in Ontario from 1 April 1999 to 31 March 2007. The cut-off date of 1999

was used because the MD dimension was first calculated for dissemination areas (DAs) in 2001 and we linked immigrants to the measured MD calculated for the DA 2 years prior to the immigrants' arrival or the 2 years following their arrival. The cut-off arrival date of 31 March 2007 allowed for a full 5-year follow-up period since the latest full health services records were available for 31 March 2012.

Further inclusion criteria for the immigrant sample were: adult age (18–105 years, excluded 25.5%), living in Ontario for entire 5-year follow-up (eg, no proof of having moved or died), and having at least one contact with the healthcare system during that time (excluded 5.1%), admission in the economic/business class, family reunification or refugee class (ie, not in the 'other' admission class, excluded 2.4%), and having immigrated from their country of birth (excluded 13.3%) since immigrants exposed to multiple immigration and resettlement experiences may be different from recent newcomers who immigrated from their birth country. Restricting the study to individuals living in urban areas led to the exclusion of 1.3% of immigrants who lived in rural areas. Subsequently we excluded 3.8% of immigrants whose neighbourhood postal codes could not be linked to census data since they could not receive an MD score. Finally, for reasons noted above, the sample was further restricted to immigrants who arrived between 1999 and 2007. This led to an immigrant sample of 545 073.

LTRs were Canadian-born or foreign-born individuals who settled in Ontario prior to 1985. LTRs were listed in the RPDB but were not in the CIC. However, immigrants who did not declare an intention to settle in Ontario were not included in the Ontario CIC. To avoid misclassifying these immigrants as LTRs, we excluded individuals absent from the CIC who became eligible for OHIP after 1999.

From these immigrant and LTR pools, further eligibility criteria were applied: being OHIP insured, adult (aged 18–105 years), and residing in a metropolitan area with data on MD score at the DA level. Of the 545 073 immigrants, 92.7% were matched on birth date (date, month and year) and sex to LTRs, creating a final sample of 505 417 immigrant–LTR matched pairs.

Variables
Outcomes
Outcomes were any outpatient visits to general practitioners or to psychiatrists, and any inpatient use for non-psychotic mental health disorders between 1999 and 2012. For each person, service use was followed for 5 years. For immigrants and their matched LTRs, it was measured over the same 5 years that followed the start of the immigrant's eligibility for OHIP. For immigrants eligibility for OHIP, the coverage begins after 3 months of residence in Ontario. For refugees this period is highly variable, but generally longer. The method for identifying non-psychotic visits to general practitioners

(using codes in supplementary appendix A) has shown a sensitivity of 81% and a specificity of 97%.[31] [32] Mental health hospital visits (a composite of ED visits or hospital admissions) were defined as those for which any diagnosis fields were related to non-psychotic mental disorders based on International Classification of Disease (ICD) codes (see supplementary appendix A). Short-term inpatient admissions (ie, 72 h or shorter) were excluded because limited classification information did not permit identification of non-psychotic disorders.

Independent variables
Material deprivation
Among the area-level social measures[33] [34] is the MD dimension in the Ontario Marginalization Index (ON-MARG)[35–37] that reflects marginalisation and shows area inequalities. It is composed of six indicators from census data (%): individual's aged 20 years and over without a high school graduation; families who are lone parent families; individuals who are receiving government transfer payments; individuals 15 years and over who are unemployed; individuals living below the low income cut-off, which is a Statistics Canada defined measure that is adjusted for community size; and households living in dwellings in need of major repair. Postal codes from the 2001 and 2006 censuses (see supplementary appendix B) were used to derive individuals' postal codes, their DA and the associated MD scores.

Since MD is an area-based index, individual health service use records were linked to the MD index associated with the individual's census DA of residence. MD scores from 2001 and 2006 were used for immigrants with landing dates from 1999 to 2003 and from 2004 to 2007, respectively. Each DA included an average of 944.5 and 1257.4 residents in 2001 and 2006, respectively. MD scores were then transformed into quintiles—higher scores/quintiles represent more deprivation.

Immigrant status
Persons were classified either as immigrants or LTRs (long-term immigrants or Canadian-born individuals) based on the CIC and RPDB.

Interaction term
To test for intersectionality, an interaction term was developed that represented the combined effect of MD quintile and immigrant status (immigrants vs LTR) on mental health service use.

Immigration characteristics
Descriptive information on immigrants (birth date, sex, source country, birth country, admission class, education level at landing, language spoken and period of arrival) was obtained from the CIC.

Sex
Analyses were stratified by sex as females are more likely than males to experience non-psychotic mental health

disorders and more likely to use mental health services.[38–44] In Canada, females are less likely than males to be employed and earn less.[45]

Analysis

Since MD is an area variable, we examined the appropriateness of a multilevel analysis by running a random intercept generalised linear mixed model to account for variation in the response variables attributable to persons living in the same area. In the multilevel generalised linear mixed model, random variation among DAs was not significant, so the random intercept was dropped from the model. The 17 879 DAs represented 1 059 295 individuals, with an average of 59.2 residents per DA (centiles—25th: 26 people, 50th: 40 people, 75th: 65 people; maximum: 1553 people).

Demographic characteristics were calculated for immigrants across MD quintiles and for LTRs by sex. Student t tests and χ^2 tested if the differences across immigrants in different MD quintiles were statistically significant.

The likelihood of use of three services for non-psychotic mental health disorders (primary care, psychiatry care and hospital care) was examined using conditional logistic regression models.[46] For each outcome, three models were run: (1) with MD quintile as the only predictor, (2) with the interaction term (MD quintile by immigrant status) and with sex as a covariate and (3) sex stratified with the interaction term. Significance testing of the interaction term determined if the relationship between MD and health service use was different for immigrants compared with LTRs for each sex. From each model we obtained estimates of expected number of users per service per 100 individuals from the least squares–means. Testing determined if estimates for adjacent MD quintiles were significantly different from each other. The inverse-link transformation was used to obtain event probabilities from the presented estimates of the linear predictors on the logit scale. To visually represent the relationship between MD and mental healthcare use for immigrants and LTRs the estimates were plotted on line graphs. Characteristics from the CIC that applied to immigrants could not be included in the adjusted models since there was no comparable data for LTRs.

Sensitivity analyses

Sensitivity analyses addressed two issues. The first pertained to how MD quintile score was determined since immigrants tend to be transient, especially after arrival.[13] In the main analysis, MD quintile was determined from individuals' first postal codes over the 5-year outcome window. In the sensitivity analysis, the postal code closest to the end of the individual's 5-year outcome window was used instead. Models were rerun with the MD quintile derived from the last postal code.

The second pertained to the definition of mental health hospitalisations. In the main analysis, a hospital admission or ED visit was included if any diagnosis in the admission record (admissions may have up to 25 diagnoses and ED visits may have up to 10 diagnoses) was a mental health diagnosis. In the sensitivity analysis, these visits were included only if a mental health diagnosis was the most responsible diagnosis. The most responsible diagnosis is determined from the primary care provider's documentation, and refers to the diagnosis or condition identified as being most responsible for the patient's stay in hospital according to the WHO's Rules and Guidelines for Mortality and Morbidity Coding.[47]

RESULTS

Overall, a higher proportion of immigrants than LTRs lived in areas in the most deprived quintile (immigrants: 22.8% of males and 22.3% of females; LTRs: 13.1% of males, 13.1% of females, p values <0.0001, see figure 1A, B). Immigrants in more deprived MD quintiles were more likely to be younger and admitted as refugees compared with immigrants in less deprived quintiles (table 1). Conversely, they were less likely to be admitted in the economic class, to have greater than high school education and to speak English or French (females only).

Area deprivation and mental health service use

For the whole sample, increasing deprivation was associated with increasing use of primary care and hospital care (table 2). For psychiatric care, use was most common by those in the most deprived and least deprived quintiles.

Immigrant status and mental health service use

For all outcomes, immigrants used less mental healthcare than their matched LTRs. This relationship persisted across all deprivation quintiles with one exception—immigrant and LTR males in the most deprived quintiles were not significantly different from each other (immigrant males: 31.51%; LTR males: 32.08%, p=0.0849, figure 2A, table 2).

### Intersectional analysis: area deprivation, immigration and mental healthcare use

For each of the sex-stratified models, the interaction between deprivation quintile and immigrant status was significant (all p values <0.001). The positive association between deprivation and mental healthcare use (high deprivation, with high use) observed among LTRs was modified among recent immigrants (high deprivation, with slightly higher use).

For immigrants and LTRs, living in more deprived quintiles was associated with small but mostly significant increases in primary mental health service use. The exception was male LTRs for whom changes in use across MD quintiles were mostly non-significant (table 2, figure 2).

For immigrants, the relationship between deprivation and psychiatric care use was variable across levels of MD. For LTRs living in more deprived quintiles was associated with small increases in use of psychiatric care (table 2, figure 2).

Figure 1 Distribution across material deprivation (MD) quintiles of recent immigrants who arrived in urban Ontario between 1999 and 2007, and their matched long-term residents, by sex (F, female; M, male).
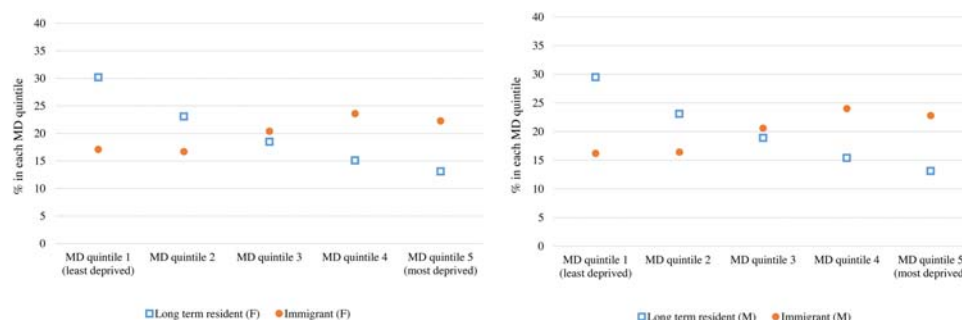
For immigrants and LTRs, expected use of hospital care was higher for people in more deprived quintiles, with much greater increases for LTRs than for immigrants (table 2; figure 2).

Sensitivity analyses

The first sensitivity analysis compared outcomes for MD quintiles based on the individuals' first and last postal codes during the study window. Although over 60% of immigrants and over 50% of LTRs moved to areas associated with different MD quintiles during the 5-year outcome window (immigrants—males: 62.6%; females: 61.3%; LTRs—males: 51.9%; females: 51.8%), results were substantially the same as the primary analysis (see supplementary appendix C). One small difference was that in the primary analysis, there was no significant difference between persons in the most deprived versus the least deprived quintiles in their likelihood of seeing a psychiatrist, whereas the difference was significant in the sensitivity analysis.

The second sensitivity analysis compared the relationship between deprivation, immigrant status and hospital use, using two different definitions of hospital use. For LTRs, the results were generally the same as the primary analysis—there was increased use by persons in more deprived quintiles. However, for immigrants in the sensitivity analysis there was no clear linear trend of increased use across quintiles and differences between quintiles were mostly non-significant (see supplementary appendix C). In the primary analysis, for immigrants there was increasing trend of greater hospital use by individuals in more deprived areas, although not all differences were significant.

DISCUSSION

This study found that immigrant status and deprivation had a combined effect on immigrants' mental healthcare use. While for both immigrants and LTRs residence in more deprived quintiles was associated with increased use of primary mental healthcare and hospital mental health services, the increase was smaller for recent immigrants compared with LTRs.

To the best of the authors' knowledge, this is the first study to examine the combined effect of neighbourhood deprivation and immigrant status on mental health

service use at the population level. It suggests that policy-makers focused on improving health and healthcare of marginalised groups, such as immigrants, should broadly address inter-related social circumstances/roles that can individually or in combination deter use of services by vulnerable groups.

Weaker relationships between MD and health service use by immigrants than LTRs may reflect immigrants' exposure to unique structural and cultural factors that inhibit help seeking (eg, difficulties identifying available resources, fear of being misunderstood or being discriminated against by practitioners, etc).[48–52] In addition, while the MD index is broad and multidimensional, some variables included in this index may not be sensitive indicators of variation in deprivation for immigrants. For example, having more education is generally associated with greater employment income for the general population. However, this relationship is weaker for immigrants who are more commonly underemployed or not employed.[53]

The observed slight but consistent increases in the likelihood of use of primary mental healthcare by people in more deprived areas depart from the body of literature on various populations that has not shown positive associations between deprivation and primary mental healthcare use. It is, however, consistent with other Canadian studies on general use of healthcare that have found that lower income and education groups were more likely than advantaged groups to contact physicians and hospital services.[54–57] If mental health morbidity is greater among those with higher deprivation,[19 58–64] present findings may be construed as aligning with recommended care use patterns. Ontario is among the jurisdictions that have made efforts to increase primary care use by more marginalised and disadvantaged groups.[65 66]

Psychiatric care was distinct from the other forms of care under study because there was no consistent pattern observed between deprivation level and psychiatric care use, suggesting a complex relationship between deprivation and publically insured psychiatric care. This may warrant further attention, particularly if deprivation is a proxy for need,[19 58–64] since services do not appear to follow need. Immigrants routinely settle in urban areas, such as Toronto—Ontario's largest urban centre.[67] Similarly, psychiatrists tend to be concentrated

Table 1 Characteristics for recent immigrants who arrived in urban Ontario between 1999 and 2007 by material deprivation (MD) quintile, and by sex

	MD quintile 1 (least deprived)	MD quintile 2	MD quintile 3	MD quintile 4	MD quintile 5 (most deprived)	Total	p Value
Females							
N (%)	49 921 (17.1)	48 800 (16.7)	59 822 (20.4)	69 075 (23.6)	65 145 (22.3)	292 763	<0.001
Age (years)							
Mean±SD	37.50±14.00	36.22±13.15	35.55±12.42	34.88±11.80	34.55±11.65	35.62±12.56	<0.001
Age (years, categories)							
18–34	26 539 (15.8)	27 420 (16.3)	34 430 (20.5)	40 886 (24.3)	38 658 (23)	26 539 (15.8)	
35–49	13 936 (16.5)	13 786 (16.3)	17 232 (20.4)	20 226 (23.9)	19 323 (22.9)	13 936 (16.5)	
50–64	6158 (21.8)	5210 (18.4)	5842 (20.6)	5795 (20.5)	5294 (18.7)	6158 (21.8)	
65+	3288 (27.3)	2384 (19.8)	2318 (19.3)	2168 (18)	1870 (15.5)	3288 (27.3)	
Admission class							
Economic	24 156 (48.4%)	22 994 (47.1%)	27 872 (46.6%)	31 903 (46.2%)	25 677 (39.4%)	132 602 (45.3%)	<0.001
Family	23 485 (47.0%)	22 428 (46.0%)	25 894 (43.3%)	28 075 (40.6%)	25 898 (39.8%)	125 780 (43.0%)	
Refugee	2280 (4.6%)	3378 (6.9%)	6056 (10.1%)	9097 (13.2%)	13 570 (20.8%)	34 381 (11.7%)	
Period of arrival							
1998–2002	23 846 (47.8%)	23 272 (47.7%)	27 183 (45.4%)	32 928 (47.7%)	31 054 (47.7%)	138 283 (47.2%)	<0.001
2003–2007	26 075 (52.2%)	25 528 (52.3%)	32 639 (54.6%)	36 147 (52.3%)	34 091 (52.3%)	154 480 (52.8%)	
Education level							
None	1709 (3.4%)	1940 (4.0%)	2479 (4.1%)	2794 (4.0%)	3317 (5.1%)	12 239 (4.2%)	<0.001
High school	14 822 (29.7%)	15 498 (31.8%)	19 833 (33.2%)	24 208 (35.0%)	27 492 (42.2%)	101 853 (34.8%)	
More than high school	33 390 (66.9%)	31 362 (64.3%)	37 510 (62.7%)	42 073 (60.9%)	34 336 (52.7%)	178 671 (61.0%)	
Language							
English/French	33 530 (67.2%)	30 316 (62.1%)	35 218 (58.9%)	39 861 (57.7%)	38 434 (59.0%)	177 359 (60.6%)	<0.001
Neither	16 391 (32.8%)	18 484 (37.9%)	24 604 (41.1%)	29 214 (42.3%)	26 711 (41.0%)	115 404 (39.4%)	<0.001
Males							
N (%)	40 892 (16.2)	41 273 (16.4)	51 949 (20.6)	60 622 (24)	57 574 (22.8)	252 310	
Age (years)							
Mean±SD	38.09±13.21	37.00±12.48	36.37±11.72	35.86±11.08	35.33±10.91	36.39±11.81	<0.001
Age (years, categories)							
18–34	19 740 (15.15)	21 026 (16.14)	27 093 (20.8)	31 726 (24.35)	30 688 (23.56)	130 273 (100)	<0.001
35–49	14 171 (15.63)	14 238 (15.71)	18 398 (20.29)	22 496 (24.82)	21 351 (23.55)	90 654 (100)	
50–64	4392 (20.0)	4073 (18.54)	4574 (20.83)	4684 (21.33)	4240 (19.31)	21 963 (100)	
65+	2589 (27.48)	1936 (20.55)	1884 (20.0)	1716 (18.22)	1295 (13.75)	9420 (100)	
Admission class							
Economic	24 773 (60.6%)	24 455 (59.3%)	30 475 (58.7%)	35 160 (58.0%)	28 929 (50.2%)	143 792 (57.0%)	<0.001
Family	13 594 (33.2%)	13 057 (31.6%)	14 789 (28.5%)	15 600 (25.7%)	14 591 (25.3%)	71 631 (28.4%)	
Refugee	2525 (6.2%)	3761 (9.1%)	6685 (12.9%)	9862 (16.3%)	14 054 (24.4%)	36 887 (14.6%)	
Period of arrival							
1998–2002	20 534 (50.2%)	20 773 (50.3%)	25 054 (48.2%)	30 215 (49.8%)	29 088 (50.5%)	125 664 (49.8%)	<0.001
2003–2007	20 358 (49.8%)	20 500 (49.7%)	26 895 (51.8%)	30 407 (50.2%)	28 486 (49.5%)	126 646 (50.2%)	

Continued

Table 1 Continued

	MD quintile 1 (least deprived)	MD quintile 2	MD quintile 3	MD quintile 4	MD quintile 5 (most deprived)	Total	p Value
Education level							<0.001
None	675 (1.7%)	816 (2.0%)	1085 (2.1%)	1139 (1.9%)	1228 (2.1%)	4943 (2.0%)	
High school	9499 (23.2%)	10 844 (26.3%)	14 160 (27.3%)	17 236 (28.4%)	20 095 (34.9%)	71 834 (28.5%)	
More than high school	30 718 (75.1%)	29 613 (71.7%)	36 704 (70.7%)	42 247 (69.7%)	36 251 (63.0%)	175 533 (69.6%)	
Language							<0.001
English/French	31 198 (76.3%)	29 636 (71.8%)	36 322 (69.9%)	42 764 (70.5%)	42 021 (73.0%)	181 941 (72.1%)	
Neither	9694 (23.7%)	11 637 (28.2%)	15 627 (30.1%)	17 858 (29.5%)	15 553 (27.0%)	70 369 (27.9%)	

in this urban region; the ratio of number of psychiatrists to the population in Toronto exceeds the ratio recommended by Canadian Psychiatric Association.[68] Even so, present findings suggest immigrants have limited access to psychiatry, accentuating the difference between availability and accessibility of health services.[69] This appears to support conclusions in a recent Ontario study[68] that the actual availability of psychiatrists in Toronto is much lower than the apparent availability since many psychiatrists care for relatively small number of high-income patients.

Even though living in disadvantaged circumstances have been linked to elevated risk of mental health disorders,[19 58–64] immigrants used less of all mental health services than LTRs. Reasons for lower use may relate to disadvantage, other access barriers unique to newcomers or lower need, possibly due to self-selection and/or screening prior to arrival.[70 71]

Limitations

There were some limitations associated with the data sources used. The absence of information on mental health need, barriers, social support and use of non-insured services limited conclusions regarding potential drivers of these findings. Another data limitation is that the MD index and census derived variables (eg, urban–rural status) are measured once per 5 years and may change over time.

Regarding outcome measures, short-term hospital admissions and non-insured supports, such as Community Health Centres (CHCs), could not be included. While CHCs serve higher proportions of newcomers than other primary care models in Ontario,[70] CHCs still only serve small proportions of immigrants (1.4% of recent newcomers). Hence, their exclusion likely did not significantly bias results.[72] A related limitation is that mental health service use was only tracked when persons were covered by OHIP. While immigrants receive OHIP coverage after 3 months in Ontario, refugees can only apply for OHIP coverage after their claim has been accepted (generally more than 1 year).[73 74] Consequently, refugees' first years of OHIP coverage often do not immediately follow their arrival.

Since this study exclusively examined service use for non-psychotic disorders, results cannot be extrapolated to psychotic disorders. Since psychotic and non-psychotic disorders are so different (eg, in aetiology, symptom profile, acuity, common pathways to care and prevalence),[5] service use for psychotic disorders was beyond the scope of the current work, but may be investigated in future studies.

Finally, this study did not include immigrants absent from the CIC—immigrants who entered Ontario from a different province; refugee claimants who have not been accepted or are appealing; other temporary residents/workers/visitors; or 'non-status' residents. Immigrants living in rural areas were also excluded although during the 2000s, only 5–8% of new immigrants to Canada

Table 2 Expected use of three mental health services by MD Q, by immigrant status and sex

| | Estimates* for expected use for mental healthcare services by MD Q | | | | | p Values for MD Q comparisons | | | | Ratio of most deprived to least deprived Q, and p value |
| | Least deprived | | Q3 | Most deprived | | Less deprived | | More deprived | | |
	Q1	Q2	Q3	Q4	Q5	Q2 vs Q1	Q3 vs Q2	Q4 vs Q3	Q5 vs Q4	Q5/Q1†, p value
Primary mental healthcare										
Deprivation as only predictor										
Whole sample	36.47	36.35	36.70	37.43	39.10	0.389‡	0.0168	<0.0001	<0.0001	1.07, <0.0001
Deprivation, immigrant status, sex as predictors										
Immigrant	32.64	32.67	34.09	35.37	37.21	0.544	<0.0001	<0.0001	<0.0001	1.14, <0.0001
LTR§	37.38	37.71	38.18	38.99	40.61	0.079	0.028	0.0007	<0.0001	1.09, <0.0001
Sex-stratified models that include an immigrant status by MD interaction										
Immigrant (female)	38.71	38.70	40.31	41.64	43.57	NS	<0.0001	<0.0001	<0.0001	1.13, <0.0001
LTR§ (female)	45.35	45.88	46.46	47.43	49.32	0.043	0.050	0.004	<0.0001	1.09, <0.0001
Immigrant (male)	27.22	27.49	28.64	29.81	31.51	NS	0.001	<0.0001	<0.0001	1.16, <0.0001
LTR§ (male)	29.81	29.92	30.27	30.87	32.08	NS	NS	NS	0.001	1.08, <0.0001
Psychiatric care										
Deprivation as only predictor										
Whole sample	5.13	4.62	4.442	4.373	4.781	<0.0001	0.0018	0.424	<0.0001	0.93, <0.0001
Deprivation, immigrant status, sex as predictors										
Immigrant	3.00	2.71	2.67	2.84	3.07	0.0002	0.6311	0.0108	0.0007	1.02, 0.3488
LTR§	6.27	5.97	6.35	6.76	7.73	0.0012	0.0002	0.0005	<0.0001	1.23, <0.0001
Sex-stratified models that include an immigrant status by MD interaction										
Immigrant (female)	3.38	3.11	3.06	3.28	3.41	0.014‡	NS	0.024‡	NS	1.01, 0.798
LTR§ (female)	7.18	6.88	7.24	7.67	8.85	0.032‡	0.020	0.015‡	<0.0001	1.23, <0.0001
Immigrant (male)	2.69	2.36	2.34	2.45	2.80	0.003‡	NS	NS	0.000	1.04, 0.278
LTR§ (male)	5.45	5.13	5.56	5.98	6.72	0.014‡	0.003	0.011	<0.0001	1.23, <0.0001
Hospital mental healthcare										
Deprivation as only predictor										
Whole sample	1.91	2.12	2.13	2.24	2.78	<0.0001	0.7315	0.0156	<0.0001	1.46, <0.0001
Deprivation, immigrant status, sex as predictors										
Immigrant	1.25	1.27	1.29	1.38	1.56	0.7706	0.6311	0.0108	<0.0001	1.25, <0.0001
LTR§	2.20	2.66	30.11	3.54	4.83	<0.0001	<0.0001	<0.0001	<0.0001	2.20, <0.0001
Sex-stratified models that include an immigrant status by MD interaction										
Immigrant (female)	1.58	1.60	1.66	1.78	2.02	NS	NS	NS	0.002	1.28, <0.0001
LTR§ (female)	2.55	3.09	3.44	4.10	5.68	<0.0001	0.001	<0.0001	<0.0001	2.23, <0.0001
Immigrant (male)	0.96	0.97	0.95	1.01	1.14	NS	NS	NS	0.025	1.19, 0.005
LTR§ (male)	1.96	2.34	2.70	3.11	4.15	<0.0001	0.000	0.001	<0.0001	2.12, <0.0001

*Estimates of expected number of users per service per 100 males and per 100 females were obtained from sex-stratified models that included an interaction between MD Q and immigrant status.
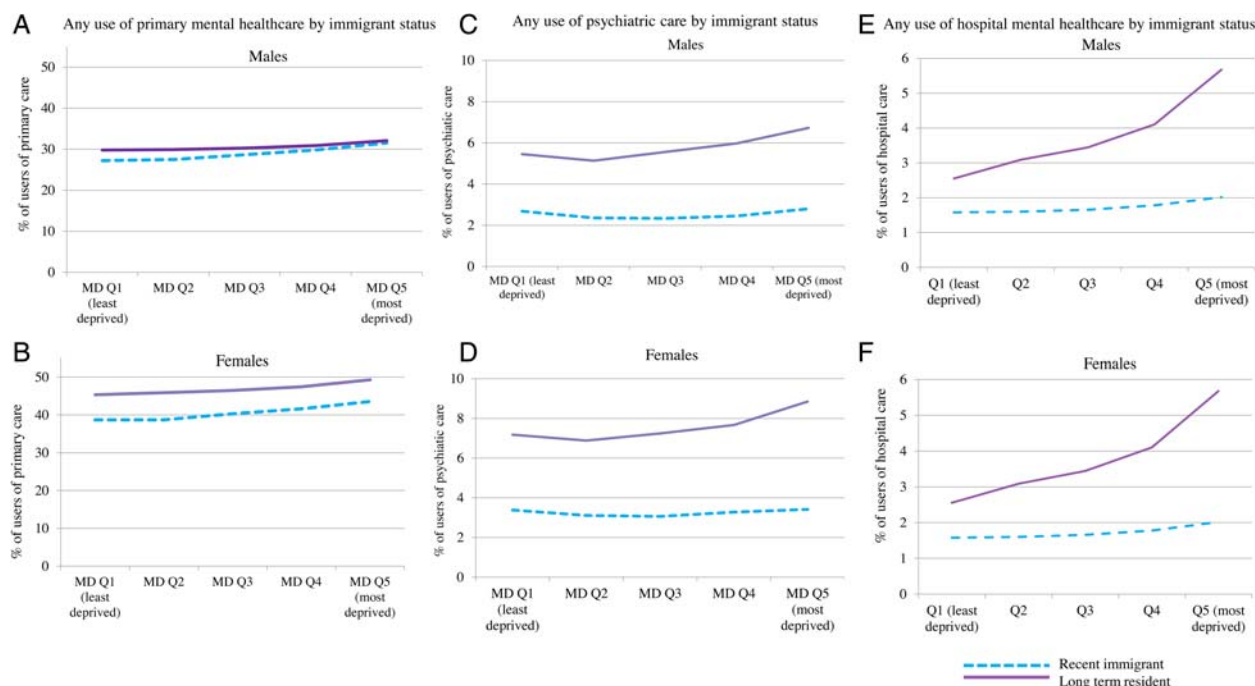†The most deprived Q was compared with the least deprived Q.
‡Estimates in the marked Q is significantly larger than the estimate for the next (more deprived) Q for the same group.
§LTR (Canadian-born or immigrants who arrived in Ontario prior to 1985).
LTR, long-term resident; MD, material deprivation; NS, not significant; Q, quintile.

Figure 2 Expected use (%) of primary care, psychiatric care and hospital care for non-psychotic mental health disorders for recent immigrants and long-term residents, by sex. †The material deprivation dimension from the Ontario Marginalization Index (ON-MARG) reflects area marginalization. ‡LTRs were Canadian born or immigrants who arrived in Ontario prior to 1985 (LTRs, long-term residents; MD, material deprivation; Q, quintile).

settled in rural areas.[67] Present results were not likely to be strongly affected by this limitation given the large sample of immigrants in this study and the smaller relative size of newcomers excluded because they are absent from the CIC[75] and live in rural areas.[67]

In spite of these limitations, this study adds to existing research by examining the effect of a broad measure of MD on recent immigrants, for whom this relationship has not been examined. Linkage of population-based databases allowed for inclusion of a large group of newcomers—almost all immigrants who applied to settle in Ontario over an extended period (1999–2007). In addition, newcomers were matched to a standard comparison group (LTRs) on birth date and sex, which controlled for two important sources of variation. Using data from administrative sources was another strength since it is more objective than survey-derived data that are commonly used for research in this area and are often affected by biases (ie, recall, reporting and selection), and missing information.[3 76–79] Finally, usage of an intersectionality lens represents a shift from focusing on direct effects by taking into account multiple facets of individuals and contexts, and multiple effects on outcomes.[80]

CONCLUSION
This population-based cross-sectional study considered the inter-relationship between disadvantage and immigration and health service use. Results indicate that while disadvantage and immigration each appear to affect mental health service use separately, they also have a combined effect that is complex. This first investigation of the relationship between MD and healthcare use for non-psychotic mental health disorders among immigrants was conducted in a large Canadian province where immigrants compose over one-quarter of the population and physician-provided services are insured. Consistent with other literature, immigrants were over-represented in deprived areas and used less care. This study added to existing research by suggesting that immigrant status and deprivation had a combined effect on immigrants' mental healthcare use. Weaker relationships for immigrants provided an indication that their use of mental health services is influenced by factors beyond disadvantage. Policymakers who want to increase immigrants' access of mental health services should broadly address the influence of structural and cultural factors beyond disadvantage.

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APPENDICES

APPENDIX A: Codes for Psychotic and Non Psychotic Disorders [27, 28]

Non-Psychotic Disorders:

Anxiety neurosis, hysteria, neurasthenia, obsessive – compulsive neurosis, reactive depression, personality disorders sexual deviations, psychosomatic illness, tics, anorexia nervosa adjustment reaction, depressive disorder, economic problems, marital difficulties, parent- child problems, problems with aged parents or in-laws, family disruption/ divorce, education problems, illegitimacy, social maladjustment, occupational problems, legal problems, other problems of social adjustment

300, 301, 302, 306, 307, 309, 311

897, 898, 899, 900, 901, 902, 904, 905, 906, 909

F32 (Not F32.3), F34.0, F34.1 F38, F39, F41, F42, F43, F44, F45, F48, F52, F60, F61, F62, F64, F65 F66, F68,

APPENDIX B: Details on Statistics Canada's urban-rural designation

Census data were provided by Statistics Canada. The census takes place every five years in Canada and is a reliable source of information for population and dwelling counts, as well as demographic and other socioeconomic characteristics. This study used Statistics Canada urban-rural variables.

Area-level urban versus rural designations. Statistics Canada's methodology established an urban-rural dichotomy for Canada. It has defined urban areas using the same methodology based on population size and density since the 1971 Census. An urban area was defined as having a population of at least 1,000 and a density of 400 or more people per square kilometre. All territory outside an urban area was defined as rural area. Together, urban and rural areas covered the entire nation. [80]

APPENDIX C: SENSITIVTY ANALYSIS RESULTS

Appendix C Table 1. Comparing sensitivity analysis results to primary analysis results: Expected use of three mental health services by material deprivation (MD) quintile, by immigrant status and sex, determined from stratified models that include an immigrant status by MD interaction.

	Estimates for expected use for mental health care services by material deprivation (MD) quintile (Q)					P-values for material deprivation (MD) quintile (Q) comparisons				
	Least deprived			Most deprived		Less deprived		More deprived		Most deprived vs least deprived quintiles
	Q1	Q2	Q3	Q4	Q5	Q2 vs Q1	Q3 vs Q2	Q4 vs Q3	Q5 vs Q4	Q5 vs Q1[†]
Primary mental health care										
Sensitivity analysis 1[§] -- Material deprivation quintile from last postal code over 5-year outcome window										
Immigrant (F)	39.62	39.86	40.38	41.24	44.84	<0.0001	NS	0.003	<0.0001	<0.0001
LTR[‡] (F)	45.62	45.73	46.58	47.31	49.62	NS	0.004	0.028	<0.0001	<0.0001
Immigrant (M)	27.92	28.28	28.47	29.87	32.69	NS	NS	<0.0001	<0.0001	<0.0001
LTR[‡] (M)	29.52	29.94	30.38	31.25	32.39	NS	NS	0.008	0.002	<0.0001
Primary analysis -- Material deprivation quintile from first postal code over 5-year outcome window										
Immigrant (F)	38.71	38.70	40.31	41.64	43.57	NS	<.0001	<.0001	<0.0001	<0.0001
LTR[‡] (F)	45.35	45.88	46.46	47.43	49.32	0.043	0.050	0.004	<0.0001	<0.0001
Immigrant (M)	27.22	27.49	28.64	29.81	31.51	NS	0.001	<.0001	<0.0001	<0.0001
LTR[‡] (M)	29.81	29.92	30.27	30.87	32.08	NS	NS	NS	0.001	<0.0001
Psychiatric care										
Sensitivity analysis 1[§] -- Material deprivation quintile from last postal code over 5-year outcome window										
Immigrant (F)	3.36	3.04	3.00	3.19	3.91	NS	NS	NS	<0.0001	<0.0001
LTR[‡] (F)	6.84	6.74	7.26	8.02	9.48	NS	0.0007	<0.0001	<0.0001	<0.0001
Immigrant (M)	2.79	2.29	2.25	2.78	2.63	0.002	NS	<0.0001	<0.0001	<0.0001
LTR[‡] (M)	1.77	1.94	2.11	2.17	2.18	NS	NS	<0.0001	<0.0001	<0.0001
Primary analysis -- Material deprivation quintile from first postal code over 5-year outcome window										
Immigrant (F)	3.38	3.11	3.06	3.28	3.41	0.014*	NS	0.024*	NS	0.798

Group	Q1	Q2	Q3	Q4	Q5					
LTR‡ (F)	7.18	6.88	7.24	7.67	8.85	0.032*	0.020	0.015*	<.0001	<0.0001
Immigrant (M)	2.69	2.36	2.34	2.45	2.80	0.003*	NS	NS	0.000	0.278
LTR‡ (M)	5.45	5.13	5.56	5.98	6.72	0.014*	0.003	0.011	<0.0001	<0.0001
Hospital mental health care										
Sensitivity analysis 1§ -- Material deprivation quintile from last postal code over 5-year outcome window										
Immigrant (F)	1.54	1.59	1.65	1.72	2.32	NS	NS	<0.0001	<0.0001	<0.0001
LTR‡ (F)	2.43	3.02	3.44	4.47	5.76	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Immigrant (M)	0.90	0.89	0.95	1.04	1.33	NS	NS	NS	<0.0001	<0.0001
LTR‡ (M)	1.84	2.20	2.42	3.31	4.56	<0.0001	0.042	<0.0001	<0.0001	<0.0001
Sensitivity analysis 2§ – Defining mental health hospitalizations using most responsible diagnosis										
Immigrant (F)	0.35	0.38	0.34	0.45	0.44	NS	NS	0.001	NS	0.04
LTR‡ (F)	0.53	0.68	0.81	0.88	1.17	0.0002	0.01	NS	<0.0001	<0.0001
Immigrant (M)	0.23	0.22	0.19	0.24	0.22	NS	NS	NS	NS	NS
LTR‡ (M)	0.47	0.49	0.63	0.74	0.96	NS	0.004	NS	0.002	<0.0001
Primary analysis -- Material deprivation quintile from first postal code over 5-year outcome window										
Immigrant (F)	1.58	1.60	1.66	1.78	2.02	NS	NS	NS	0.002	<0.0001
LTR‡ (F)	2.55	3.09	3.44	4.10	5.68	<.0001	0.001	<.0001	<.0001	<0.0001
Immigrant (M)	0.96	0.97	0.95	1.01	1.14	NS	NS	NS	0.025	0.005
LTR‡ (M)	1.96	2.34	2.70	3.11	4.15	<.0001	<0.0001	0.001	<.0001	<0.0001

[†] The most deprived quintile compared to the least deprived quintile

[‡] LTR=Long term resident (Canadian-born or immigrants who arrived in Ontario prior to 1985)

[§] The p-value for the interaction between immigrant status and MD quintile remained significant for both sensitivity analyses (Sensitivity analysis1: all p-values <0.008; Sensitivity analysis 2: all p-values <0.0001).

* Estimates in the marked quintile is significantly larger than the estimate for the next (more deprived) quintile for the same group