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Trends in mental health service utilization in immigrant youth in Ontario, Canada, 1996 to 2012: a population-based longitudinal cohort study.

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3 1 Trends in mental health service utilization in immigrant youth in Ontario, Canada, 1996 to 2012: a
4 2 population-based longitudinal cohort study.

5 3
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22 20

23 21 **Key words:** pediatrics, immigration, refugee, mental health, access
24 22

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43 41 omitted. Any discrepancies from the study as planned have been explained.
44 42

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46 44 restriction. Data are available from the Institute for Clinical Evaluative Sciences (ICES)
47 45 Institutional Data Access for researchers who meet the criteria for access to confidential data.
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3 46 Contact natasha.saunders@sickkids.ca for data access. Individual patient consent was not obtained
4 47 but the presented data are anonymized and risk of identification is low.
5 48

6 49 **Contributors' Statement:** N. Saunders conceptualized and designed the study, interpreted the
7 50 results, drafted the initial manuscript, revised the manuscript, and approved the final manuscript as
8 51 submitted. M. Lebenbaum, T. Stukel, M. Urquia, and A. Guttmann conceptualized and designed the
9 52 study, interpreted the results, revised the manuscript, and approved the final manuscript as
10 53 submitted. H. Lu conceptualized and designed the study, had access to and analysed the data,
11 54 interpreted the results, revised the manuscript, and approved the final manuscript as submitted. All
12 55 authors approved the final manuscript as submitted and agree to be accountable for all aspects of
13 56 the work.
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3 65 **Abstract**

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5 66 **Objective:** To describe trends in mental health service use of youth by immigration status and
6
7 67 characteristics.

8
9 68 **Design:** Population-based longitudinal cohort study from 1996 to 2012 using linked health and
10
11 69 administrative datasets.

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13
14 70 **Setting:** Ontario, Canada.

15
16 71 **Participants:** Youth 10 to 24 years, living in Ontario, Canada

17
18 72 **Exposure.** The main exposure was immigration status (recent immigrants vs. long-term residents).
19
20
21 73 Secondary exposures were region of origin and refugee status.

22
23 74 **Main Outcome Measure:** Mental health hospitalizations, emergency department visits, and
24
25 75 outpatient visits within consecutive 3-year time periods. Poisson regression models estimated rate
26
27 76 ratios (RR).

28
29
30 77 **Results:** Over 2.5 million person years per period were included. Rates of recent immigrant mental
31
32 78 health service utilization were at least 40% lower than long-term residents ($p<0.0001$). Mental
33
34 79 health hospitalization and emergency department visit rates increased in long-term residents
35
36 80 (hospitalizations, RR 1.09 (95% confidence intervals 1.08-1.09); emergency department visits, RR
37
38 81 1.15 (1.14-1.15)) and recent immigrants (hospitalizations RR 1.05 (1.03-1.07); emergency
39
40 82 department visits, RR 1.08 (1.05-1.11)). Mental health outpatient visit rates increased in long-term
41
42 83 residents (RR 1.03 (1.03-1.03)) but declined in recent immigrant (RR 0.94 (0.93-0.95)).

43
44 84 Comparable divergent trends in acute care and outpatient service use were observed among
45
46 85 refugees and across most regions of origin. Recent immigrant acute care use was driven by longer-
47
48 86 term refugees (hospitalizations RR 1.12; (1.03-1.21); emergency department visits RR 1.11 (1.02-
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50 87 1.20)).
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3 88 **Conclusions:** Mental health service utilization was lower among recent immigrants than long-term
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5 89 residents. While acute care use is increasing at a faster rate among long-term residents than recent
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7 90 immigrants, the decrease in outpatient mental health visits in immigrants highlights a potential
8
9 91 emerging disparity in access to preventative care.
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12 92 **Trial Registration:** Not Applicable.
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3 96 **Strengths and Limitations of this Study:**
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- 5 97 • This is first population-based study to evaluate trends over time in mental health service use
6
7 98 in immigrant youth in Canada and the largest such study globally.
8
9 99 • Using individual linked health and demographic databases, we were able to obtain health
10
11 services use for a broad range of mental health disorders in a large population of youth.
12 100
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14 101 • The immigration database allowed a detailed level of information about immigration
15
16 102 characteristics and is also distinguished from other mental health studies among immigrants
17
18 103 which are often survey based, self-reported (and therefore under-reported) and have smaller
19
20 104 sample sizes.
21
22
23 105 • Limitations include absence of information on mental health need, social support and
24
25 106 informal use of mental health services (e.g. religious leaders, social workers, community
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27 107 support networks).
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29
30 108 • Data on psychologist, social work, and community mental health agency use are not
31
32 109 currently available for linking.
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111 **Introduction**

112 Mental health problems among youth contribute to significant morbidity and mortality across the
113 globe, affecting one in five individuals.(1, 2) Recent population-based data suggests the burden of
114 mental health problems among youth in Ontario, Canada is rising,(1) as is mental health service use
115 in North America.(3, 4) Understanding trends over time in the utilization of mental health services
116 is critical for optimal health service delivery. Accordingly, to make appropriately targeted health
117 system improvements, identifying mental health trends in at-risk populations, including the growing
118 population of immigrant youth, is important. This is increasingly becoming essential on an
119 international scale given global migration and the current refugee crisis. Immigrants may face
120 challenges integrating pre-migration social, cultural, and political experiences and post-migration
121 resettlement stressors with their new lives as permanent residents or naturalized citizens. These
122 experiences influence the complex set of factors that shape an immigrant's ability to access health
123 services and their risk for mental health and addiction problems before, upon, and after arrival.(5-7)
124 In Canada, approximately 20% of the population are 'landed immigrants' or 'permanent residents'
125 (granted permission to live and work in Canada without limitations on one's stay). Of these, 85 to
126 90% are skilled and educated workers, arriving as non-refugees.(8) Over the past two decades,
127 shifts in immigration patterns to Canada have occurred. In particular, in recent years, there has
128 been a relative increase in migration of South and East Asian populations with a simultaneous
129 decline in immigrants from Eastern Europe and Central Asia.(8) These shifts are, in part, reflective
130 of changes to Canadian immigration policy over time(9, 10) and indicative of changing drivers of
131 global migration including political instability, economic opportunity, and family reunification.
132 Changes to pre- and post-immigration exposures that may influence mental health service need,
133 utilization, and access may accompany these variations in migration.

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3 134 Existing literature on the epidemiology of mental health problems in immigrant youth is
4
5 135 inconsistent and typically based on smaller sub-sets of immigrants, most of which, rely on self-
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7 136 report.(5, 6, 11-13) Social deprivation, common among immigrants, is often cited as a risk factor
8
9 137 for mental health problems(14, 15) but protective immigration factors may counter this risk.(16)
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11
12 138 One Danish population-based, administrative database study(17) showed higher rates of mental
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14 139 health problems in immigrants compared with non-immigrants. This is in contrast to other
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16 140 population-based North American and other European studies in both adolescents and adults where
17
18 141 there is a more pronounced 'healthy immigrant effect' – that is, individuals arrive in better health,
19
20 142 with lower rates of mental health problems, than their native-born counterparts.(7, 18, 19) This
21
22 143 may be due to differences in immigration policies in receiving countries that select for healthier,
23
24 144 more able-bodied individuals. Literature on the mental health of immigrant youth in Canada is
25
26 145 limited to a few small survey studies that suggest lower rates of mental health problems among
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28 146 immigrants.(20, 21)
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32 147 Despite the substantial proportion of health services concentrated on mental health care and
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34 148 Canada's large and evolving immigrant population, little is known about the how mental health
35
36 149 service use has changed over time in immigrants. In this study, we aimed to describe the time trends
37
38 150 in mental health service utilization in recent immigrant youth in Ontario compared with long-term
39
40 151 residents. We also sought to describe these time trends among sub-groups of immigrants, including
41
42 152 by immigrant class, duration of residency in Canada, and region of origin. We hypothesized that
43
44 153 overall, immigrants would have lower utilization of the health care system for mental health
45
46 154 compared with long-term residents. However, we expected increasing rates of use in both recent
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48 155 and long-term residents given widespread efforts in more recent years to reduce mental health
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50 156 stigma and improve help-seeking behaviours.(22) We hypothesize that refugees, in particular,
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3 157 would have an increasing trend in mental health use given the changes over time in Canada's
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5 158 immigration policies that have shifted refugee selection to more at-risk populations.(9, 10)
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7 159 **Methods**

8 9 160 *Study Design*

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12 161 This was a population-based longitudinal study using data available through a research agreement
13
14 162 between the Ontario Ministry of Health and Long-Term Care and the Institute for Clinical
15
16 163 Evaluative Sciences (ICES). The study was approved by the Research Ethics Board at Sunnybrook
17
18 164 Health Sciences Centre in Toronto, Ontario.

19 165 *Patient Involvement*

20
21 166 Patients were not directly involved in this study.

22 23 167 *Data Collection*

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25
26 168 Youth were identified using a unique, encoded, health identification number that linked several
27
28 169 health and administrative databases available at ICES to obtain study data. Immigrant status was
29
30 170 ascertained through the Ontario portion of the Immigration, Refugees and Citizenship Canada
31
32 171 (IRCC) Permanent Resident Database. The IRCC database contains individual level demographic
33
34 172 information from Ontario's permanent residents from 1985 to 2012.(9, 23) A number of
35
36 173 immigration characteristics were used from the database including immigrant visa class (refugee
37
38 174 versus non-refugee), duration of residence in Canada (based on the earlier of year of obtaining
39
40 175 permanent residency in Canada or the year of Ontario Health Insurance Plan (OHIP) eligibility),
41
42 176 and World Bank region of origin (based on the country of birth). The Registered Persons Database,
43
44 177 Ontario's universal health insurance registry, was used to obtain age and sex for every OHIP
45
46 178 eligible individual meeting study criteria. Emergency department (ED) visits were obtained
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48 179 through the National Ambulatory Care Reporting System (NACRS) (2002-2012) and hospital
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50 180 admissions were identified from the Canadian Institute for Health Information Discharge Abstract
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3 181 Database (CIHI-DAD) (1996-2012) and from the Ontario Mental Health Reporting System
4
5 182 (OMHRS) (2005-2012). To determine outpatient service use to physicians, mental health visits to
6
7 183 primary care physicians and psychiatrist outpatient visits were determined from the OHIP billings
8
9 184 database (1996-2012). In Ontario, residents are eligible for most hospital and physician services
10
11 185 through OHIP which acts as a single payer for the province. Immigrants with permanent resident
12
13 186 status are eligible if they have resided in Ontario for three months. Refugees with permanent
14
15 187 resident status may obtain OHIP coverage upon arrival.(24) Data from asylum-seekers (those
16
17 188 arriving in Canada and subsequently seeking refugee status) are not captured in the available
18
19 189 databases. Statistics Canada's Postal Code Conversion File was used to link patients' postal code at
20
21 190 the time of the visit to derive area level neighborhood income quintile and community size from the
22
23 191 1996, 2001, and 2006 Canadian Censuses.

28 192 *Study population*

29
30 193 All youth ages 10 to 24 years who were eligible for OHIP during the study period from 1996 to
31
32 194 2012 were included. Cohorts were grouped into 3-year periods, except for the final two study
33
34 195 years, which were grouped as a 2-year period. Youth entered the study upon their 10th birthday and
35
36 196 exited on their 25th birthday. Those with an invalid encoded health number or missing sex were
37
38 197 excluded from the study. Non-Ontario residents at the onset of the study cohort period were also
39
40 198 excluded. Finally, individuals without an IRCC record (Canadian born or immigrants who moved
41
42 199 to Ontario from another province) who first became eligible for OHIP within 5 years of each cohort
43
44 200 period were excluded to reduce the possibility of unlinked IRCC records inappropriately being
45
46 201 included as Canadian born.

51 202 *Exposure variables*

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53 203 The main exposure was immigrant status, categorized as recent immigrant or long-term resident.
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55 204 Recent immigrants were defined based on having an IRCC Permanent Resident Database record
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3 205 and a duration of residence in Ontario < 10 years. Long-term residents included all Canadian born
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5 206 Ontario residents and individuals with an IRCC Permanent Resident Database record who had
6
7 207 landed in Canada ≥ 10 years from the start of the cohort period. Immigrant status was determined at
8
9 208 the beginning of each period. Thus, recent immigrants in one period could become long-term
10
11 209 residents in a subsequent period, so long as they maintained OHIP eligibility and study age criteria.
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13

14 210 *Covariates*

15
16 211 A number of covariates were considered in the analysis. These included age, sex, neighborhood
17
18 212 income quintile within a dissemination area, and community size. Within recent immigrants,
19
20 213 covariates also included refugee status, duration of residency in Ontario (< 5 years and ≥ 5 to 10
21
22 214 years), region of origin based on modified World Bank Regions,(25) and the interaction between
23
24 215 duration of residency and refugee status, and between time with refugee status, duration of
25
26 216 residency, and region of birth.
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30 217 *Outcome measures*

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32 218 The main outcome measure was mental health service utilization, within each time period.
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34 219 Utilization was measured as all outpatient physician visits, ED visits and hospitalizations for a
35
36 220 mental health related problem. Outpatient physician mental health visits were identified using
37
38 221 OHIP billing codes and included visits to psychiatrists and visits to family physicians or
39
40 222 pediatricians where billing codes for mental health services or visits with a mental health diagnostic
41
42 223 code were used. This definition was based on a validated algorithm for ambulatory mental health
43
44 224 care modified by adding specific pediatric diagnostic codes.(26) These billings do not include
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46 225 services provided by psychologists, social workers, and community-based non-physician mental
47
48 226 health services. ED visits were identified within NACRS where the main ED diagnosis was a
49
50 227 mental health disorder (F04-F99) or a secondary diagnosis was for self-inflicted injury (intentional
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52 228 self-harm, X60-X84), both based on International Classification of Disease 9th and 10th edition
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3 229 codes. Similarly, hospitalizations were identified as any hospitalization with a mental health
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5 230 diagnostic code (F04-F99) captured in CIHI-DAD or any hospitalization to a provincially
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7 231 designated mental health hospital bed identified within OMHRS, except for admissions for
8
9 232 dementia. See Appendix A for codes used to identify mental health visits.

11 233 *Analysis*

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13
14 234 The total number of individuals, person years of exposure, and number and rate of events for each
15
16 235 cohort period were estimated. An unadjusted time trend for each outcome by immigrant status was
17
18 236 estimated. The interaction between immigrant status and time was tested and where significant,
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21 237 separate slopes for each exposure group were presented. A subgroup analysis on recent immigrants
22
23 238 was then performed to estimate an adjusted time trend for recent immigrant subgroups by region of
24
25 239 origin, refugee status, and duration of residence. The unit of analysis was the individual resident.
26
27
28 240 Multivariable models were built for each outcome, adjusting for age, sex, income quintile, and
29
30 241 community size. All analyses were estimated using Poisson regression with Generalized Estimating
31
32 242 Equations using an independent correlation structure for outpatient and ED visits and autoregressive
33
34 243 correlation structure for hospitalizations. Results are presented as rate ratios (RR). Analyses were
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37 244 conducted with SAS Enterprise Guide, version 6.1 (SAS Institute Inc., Cary, NC).

38 245 **Results**

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40
41 246 Approximately 2.5 to 2.9 million individuals contributed to each time period. Recent immigrants
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44 247 made up 9.8 to 11.5% of the cohort in each cohort period and refugees represented 17.7 to 18.0% of
45
46 248 recent immigrants. The regions of origin changed over time, initially with Europe and Central Asia
47
48
49 249 as the leading regions, and more recently South and East Asia (Table I).

50
51 250 Figure 1 shows the unadjusted time trends in rates of mental health service utilization in recent
52
53 251 immigrants and long-term residents. Mental health service utilization was much lower for
54
55 252 outpatient physician and acute care services in recent immigrants compared with long-term

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3 253 residents (all rate ratios ≤ 0.60 , $p < 0.001$) (Table II). Both ED visits and hospitalizations rates
4
5 254 increased over time in recent immigrants and long-term residents but the increase in rates was
6
7 255 higher in long-term residents (Table II). Rates of outpatient physician visits for mental health
8
9 256 increased over time in long-term residents but decreased over time in recent immigrants (Table II).
10
11
12 257 Low income and female sex were associated with an increased rate of mental health service use.
13
14 258 Late childhood and early adolescence was associated with a lower rate of mental health service use.
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16 259 Urban individuals had the lowest rate of being admitted to hospital and the highest rate of using
17
18 260 outpatient physician mental health services.
19
20
21 261 Within subgroups of immigrants, refugees had higher rates of ED visits and hospitalizations
22
23 262 compared with non-refugee recent immigrants and the recent increase in ED service use was driven
24
25 263 by refugees (Figure 2, Table III). The increase in hospitalization rates for mental health was
26
27 264 influenced primarily by refugees with a duration of residence of 5 to 10 years in Canada (Table III).
28
29
30 265 Trends in outpatient physician visit rates among recent immigrants were similar by refugee status
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32 266 and duration of residence in Canada (Figure 2, Table III).
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34
35 267 The unadjusted rates of mental health outpatient and ED visits and hospitalizations by region of
36
37 268 origin are shown in Figure 3 with adjusted rates in Table III. Across all regions, except Europe,
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39 269 Central Asia, and North America, there were convergent trends in outpatient and acute care service
40
41 270 use for mental health conditions, with outpatient service use declining and acute care service use
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43
44 271 increasing over time.

46 272 **Discussion**

48
49 273 This large population-based longitudinal study examined mental health service use over time in
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51 274 recent immigrants and long-term residents in Ontario. Patterns of mental health service use over
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53 275 time were consistently lower for outpatient physician and acute care mental health services by
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55 276 recent immigrants compared with long-term residents. Rates of acute care mental health service use
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3 277 increased over time in both groups but at a faster rate in long-term residents. Strikingly, outpatient
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5 278 physician mental health service use increased over time in long-term residents but decreased in
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7 279 recent immigrant groups. These discordant trends in outpatient and acute care mental health service
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9 280 use were observed across both refugees and non-refugee immigrants and in immigrants from most
10
11 281 world regions.

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14 282 Lower rates of mental health services use have also been observed in other large population-based
15
16 283 cross-sectional studies of Canadian adults(18, 27) and in smaller cohort studies across the globe(11,
17
18 284 28), though not consistently.(17) This variability in reported differences between mental health
19
20 285 burden in immigrant and native populations may be due to differences in immigration policies in
21
22 286 receiving countries. Some have attributed better mental health in immigrant populations to
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24 287 selective migration for healthier individuals.(29, 30) This 'healthy immigrant effect' has been
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26 288 observed for a number of adult conditions(31) but for few pediatric diseases(32, 33) and, to our
27
28 289 knowledge, has not been demonstrated in Canadian refugee youth. Lower rates of mental health
29
30 290 service use may be due to different care-seeking behaviours, with poor self-identification of mental
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32 291 health problems or more internalizing problems in immigrant populations.(20)

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37 292 In both recent immigrants and long-term residents, we found increases in ED visits and
38
39 293 hospitalizations over time. This may be a reflection of greater awareness and acceptance of mental
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41 294 health problems in recent years from reduced stigma,(22) or formal strategies to improve access to
42
43 295 mental health services in the last several years in Ontario.(34, 35) The differential rates of increase
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45 296 in acute care service use in these populations may be that strategies to improve mental health
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47 297 services and reduce mental health stigma are not reaching all populations, in particular recent
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49 298 immigrant youth. The increasing rate over time in acute care service use by refugees highlights the
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51 299 importance of the vulnerability of this population and the need for active surveillance of
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3 300 individuals, especially with the current global refugee crisis and changes to immigration policies
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5 301 that select for a larger number of more vulnerable refugees.(9)

6
7 302 The divergent trends in outpatient physician service use over time between study groups signals
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9 303 emerging differences in health service delivery for recent immigrants. This may be a reflection of
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11 304 different access to or availability of outpatient physician care or increasing stigma of mild mental
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13 305 health problems among immigrants with consequent internalization of mental health problems.
14
15 306 Moreover, there may be a lack of familiarity with mental health services in certain immigrant
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17 307 populations. Conversely, these finding may signify immigrants are increasingly receiving
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19 308 alternative, non-physician mental health services though school based programs, community mental
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21 309 health service agencies, or psychologists. The observed regional differences in outpatient trends,
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23 310 with 'Western' regions having more similar trends to long-term Canadian residents, suggests
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25 311 cultural congruency may be contributing to the observed findings. Equally, the observed
26
27 312 differences may be explained by a heavier reliance on informal supports from strong familial and
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29 313 social networks in immigrant populations.(36) This latter notion could enhance strategies to
30
31 314 improve the mental health of high use populations, including those who are native-born.

32 33 34 35 36 37 315 *Strengths and Limitations*

38
39 316 To our knowledge, this is the first study to evaluate trends over time in mental health service use in
40
41 317 immigrant youth in Canada and the largest such study globally. Using individual linked health and
42
43 318 demographic databases, we were able to obtain health services use for a broad range of mental
44
45 319 health disorders in a large population of youth. We had almost complete provincial data with
46
47 320 virtually no loss of individual records. The immigration database allowed a detailed level of
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49 321 information about immigration characteristics. This study is also distinguished from other mental
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51 322 health studies among immigrants which are often survey based, self-reported (and therefore under-
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53 323 reported), have smaller sample sizes, and are largely focused on adults.
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3 324 Limitations to this study include absence of information on mental health need, social support and
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5 325 informal use of mental health services (e.g. religious leaders, social workers, community support
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7 326 networks). Data on psychologist, social work, and community mental health agency use are not
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9 327 currently available for linking. These data would help contextualize our findings and allow us to
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11 328 understand whether observed divergent trends are related to difficulty accessing physician care or
12
13 329 rather, determine if there are differential treatment-seeking behaviours by recent immigrants. Our
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15 330 definition of mental health hospitalization did not include the small number of hospitalizations for
16
17 331 self-injury where there may have been co-existing mental illness but the injury itself was the
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19 332 diagnosis most responsible for the length of stay. Our study did not include measures of clinical
20
21 333 comorbidities which may affect mental health service use. We did not have available primary care
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23 334 data from community health centres which traditionally serve a higher proportion of immigrants
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25 335 and marginalized populations.(37) However, community health centres in Ontario serve less than
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27 336 1% of the population, of which 16% are newcomers.(37) In this study, we were not able to track
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29 337 immigrants who entered Ontario from a different province, refugee claimants awaiting a decision
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31 338 on residency, temporary residents, or 'non-status' residents. Finally, differential self-perceived
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33 339 mental health status and cultural incongruence may lead to mis-diagnosis and therefore under-
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35 340 reporting of mental health problems, by health care providers.

341 **Conclusions**

342 This large population-based longitudinal study of youth showed mental health acute care services
343 are increasing over time in recent immigrant and long-term resident populations. However, there is
344 an increasing difference in outpatient mental health service use with mental health outpatient
345 physician visits decreasing in recent immigrant populations, despite an increased acute care service
346 use over time. Future studies are needed to understand why these service differences exists to
347 ensure recent immigrants in need of mental health services are identified and able to access needed

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3 348 care. Understanding whether divergent trends are a reflection of difficulty accessing physician
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5 349 mental health care or whether alternative models of mental health service delivery are serving these
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7 350 populations is important. Development of strategies to reduce potential inequities in access and use
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9 351 with an active effort to clarify the role of mental health services for recent immigrants are essential
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12 352 to ensuring equity in the provision of mental health service for all youth.

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Table I. OHIP eligible youth by period in Ontario

	1996 to 1998	1999 to 2001	2002 to 2004	2005 to 2007	2008 to 2010	2011 to 2012
Overall, N	2521439	2692524	2824820	2929879	2887553	2714188
Immigrant Status, %						
Long-term residents	88.7	88.7	88.6	88.5	88.7	90.2
Recent immigrants	11.3	11.3	11.4	11.5	11.3	9.8
Age at Index (Years), %						
10-14	45.6	46.1	45.7	44.5	43.4	38.9
15-19	27.0	27.4	27.9	28.3	28.8	30.9
20-24	27.4	26.4	26.3	27.2	27.9	30.2
Sex						
Female	49.1	49.0	49.0	49	48.9	48.8
Male	50.9	51.0	51.0	51	51.5	51.2
Income Quintile, %						
Income missing	0.3	0.5	0.4	0.4	0.4	0.4
Income quintile 1 (lowest)	20.0	20.5	20.0	21.0	20.0	19.4
Income quintile 2	19.3	19.9	19.6	19.7	19.3	18.9
Income quintile 3	19.8	19.8	19.8	19.4	19.7	19.8
Income quintile 4	20.3	19.4	20.0	19.5	20.4	20.9
Income quintile 5	20.3	20.0	20.1	20.0	20.3	20.5
Community Size, %						
1 500 000+	45.9	40.5	41.6	42.5	43.3	43.7
500 000 – 1 499 999	5.6	12.1	12.1	12.1	12.2	12.3
100 000 – 499 999	23.9	24.0	24.0	25.1	25.1	25.2
10 000 – 99 999	9.1	9.6	9.2	8.2	7.8	7.6
< 10 000	15.6	13.8	13.2	12	11.5	11.2
Immigration characteristics						
N	284150	304991	322173	337163	326556	265061
Refugee Status, %						
Non-refugee, 0-5 years	58.5	54.7	53.7	55.4	49.4	41.5
Non-refugee, ≥5-10 years	23.8	27.5	28.4	26.9	32.6	39.9
Refugees, 0-5 years	12.4	11.1	12.5	12.7	12.5	11.2
Refugees, ≥5-10 years	5.3	6.6	5.4	5.0	5.5	7.5
Region of Birth, %						
East Asia & Pacific	22.1	21.4	21.6	22.9	23.6	24.7
Europe & C. Asia	23.4	22.0	18.3	15.8	14.0	11.6
L.A. & Caribbean	18.5	15.3	13.4	11.5	11.4	11.5
Mid East & N. Africa	9.2	10.5	11.4	12.5	13.2	14.3
North America	2.0	1.9	2.0	2.3	2.9	3.4
South Asia	17.7	21.7	26.0	28.2	28.1	27.4
Sub-Saharan Africa	7.1	7.0	7.2	6.8	6.8	7.1

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Table II. Multivariable Poisson regression models for rates of mental health hospitalizations, emergency department visits and outpatient physician visits by immigration status and over time.

	Hospitalizations	Emergency department visits	Outpatient physician visits
Parameter	RR (95% CI)	RR (95% CI)	RR (95% CI)
Immigration Status (Reference: Long-term residents)			
Recent immigrants	0.60 (0.56, 0.64)	0.49 (0.47, 0.52)	0.60 (0.59, 0.61)
Relative change per time period (Reference period 1996-1998 for hospitalizations and outpatient visits, 2002-2004 for emergency department visits)			
Time trend – Recent immigrant	1.05 (1.03, 1.07)	1.08 (1.05, 1.11)	0.94 (0.93, 0.95)
Time trend – Long-term resident	1.09 (1.08, 1.09)	1.15 (1.14, 1.15)	1.03 (1.03, 1.03)
Sex (Reference: female)			
Male	0.89 (0.87, 0.91)	0.80 (0.79, 0.82)	0.85 (0.84, 0.85)
Age (Reference: 20 to 24 years)			
Age: 10 to 14 years	0.52 (0.51, 0.53)	0.43 (0.43, 0.44)	0.49 (0.48, 0.49)
Age: 15 to 19 years	0.99 (0.98, 1.01)	1.11 (1.09, 1.12)	0.75 (0.74, 0.75)
Income (Reference quintile 5)			
Income missing	1.98 (1.78, 2.21)	2.12 (1.97, 2.29)	1.05 (0.99, 1.12)
Income quintile 1 (lowest)	1.36 (1.32, 1.40)	1.62 (1.59, 1.65)	1.03 (1.02, 1.04)
Income quintile 2	1.19 (1.16, 1.22)	1.32 (1.30, 1.35)	0.95 (0.94, 0.96)
Income quintile 3	1.08 (1.05, 1.11)	1.16 (1.13, 1.18)	0.91 (0.90, 0.92)
Income quintile 4	1.04 (1.01, 1.07)	1.07 (1.05, 1.09)	0.90 (0.89, 0.91)
Community size (Reference: 1 500 000+)			
500 000 – 1 499 999	0.95 (0.92, 0.99)	1.46 (1.42, 1.50)	1.09 (1.08, 1.10)
100 000 – 499 999	1.33 (1.30, 1.36)	1.60 (1.57, 1.63)	1.03 (1.03, 1.04)
10 000 – 99 999	1.55 (1.50, 1.60)	1.98 (1.94, 2.03)	0.94 (0.93, 0.96)
< 10 000	1.23 (1.19, 1.27)	1.81 (1.77, 1.84)	0.74 (0.74, 0.76)

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Table III. Multivariable Poisson regression models for time trends in mental health hospitalizations, emergency department visits, and outpatient physician visits within recent immigrant groups.

	Hospitalizations	Emergency department visits	Outpatient physician visits
Parameter	RR (95% CI)	RR (95% CI)	RR (95% CI)
Immigration Class			
Non-refugees, 0 to 5 years	1.04 (1.01, 1.07)	1.04 (1.00, 1.07)	0.93 (0.92, 0.94)
Non-refugees, ≥ 5 to 10 years	1.01 (0.97, 1.05)	1.05 (1.01, 1.10)	0.93 (0.92, 0.94)
Refugees, 0 to 5 years	1.02 (0.97, 1.08)	1.14 (1.07, 1.22)	0.95 (0.93, 0.96)
Refugees, ≥ 5 to 10 years	1.12 (1.03, 1.21)	1.11 (1.02, 1.20)	0.95 (0.93, 0.97)
Region of Origin			
East Asia and Pacific	1.02 (0.97, 1.07)	1.10 (1.04, 1.17)	0.93 (0.92, 0.94)
South Asia	1.05 (1.00, 1.11)	1.08 (1.02, 1.14)	0.92 (0.91, 0.94)
Sub-Saharan Africa	1.04 (0.97, 1.11)	1.10 (1.00, 1.20)	0.89 (0.87, 0.91)
Middle East and North Africa	0.98 (0.91, 1.05)	1.05 (0.98, 1.11)	0.96 (0.94, 0.98)
Latin America and Caribbean	1.08 (1.03, 1.13)	1.12 (1.06, 1.18)	0.95 (0.94, 0.97)
Europe and Central Asia	1.17 (1.11, 1.24)	1.16 (1.10, 1.22)	1.01 (0.99, 1.03)
North America	1.00 (0.89, 1.14)	0.92 (0.76, 1.13)	0.96 (0.91, 1.01)
Long-term Residents	1.09 (1.08, 1.09)	1.15 (1.14, 1.15)	1.03 (1.03, 1.03)

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3 360 **Figure 1.** Acute care and outpatient physician visits for mental health problems over time by time
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5 361 period in recent immigrants and long-term residents. (RR) Rate Ratio (CI) Confidence Interval
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7 362 (ED) Emergency Department.
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12 364 **Figure 2.** Acute care and outpatient visits for mental health problems over time by time period by
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14 365 immigration class and recency of immigration. (ED) Emergency Department.
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19 367 **Figure 3.** Acute care and outpatient mental health service use by time period and by region of
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21 368 origin. (ED) Emergency Department.
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3 **373 Abbreviations:**

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5 374 (CI) Confidence interval; (CIHI-DAD) Canadian Institute for Health Information Discharge

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7 375 Abstract Database; (ED) Emergency department; (ICES) Institute for Clinical Evaluative Sciences;

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9 376 (IRCC) Immigration, Refugees and Citizenship Canada; (LTR) Long-term resident; (NACRS)

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11 377 National Ambulatory Care Reporting System; (OHIP) Ontario Health Insurance Plan; (OMHRS)

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14 378 Ontario Mental Health Reporting System; (RI) Recent immigrants; (RR) Rate ratio.

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For peer review only

References

1. The Mental Health of Children and Youth in Ontario: A Baseline Scorecard. Toronto, ON: Institute for Clinical Evaluative Sciences, 2015.
2. Waddell C, Shepherd CA, Schwartz C, Barican J. Child and Youth Mental Disorders: Prevalence and Evidence-Based Interventions. Vancouver, BC: Children's Health Policy Centre, British Columbia Ministry of Children and Family Development, 2014.
3. Mapelli E, Black T, Doan Q. Trends in Pediatric Emergency Department Utilization for Mental Health-Related Visits. *The Journal of pediatrics*. 2015;167(4):905-10.
4. Olfson M, Druss BG, Marcus SC. Trends in mental health care among children and adolescents. *N Engl J Med*. 2015;372(21):2029-38.
5. Beiser M, Goodwill AM, Albanese P, McShane K, Nowakowski M. Predictors of immigrant children's mental health in Canada: selection, settlement contingencies, culture, or all of the above? *Social psychiatry and psychiatric epidemiology*. 2014;49(5):743-56.
6. Beiser M, Zilber N, Simich L, Youngmann R, Zohar AH, Taa B, et al. Regional effects on the mental health of immigrant children: results from the New Canadian Children and Youth Study (NCCYS). *Health & place*. 2011;17(3):822-9.
7. Beiser M, Hou F, Hyman I, Tousignant M. Poverty, family process, and the mental health of immigrant children in Canada. *American journal of public health*. 2002;92(2):220-7.
8. Facts and figures 2013. Immigration overview – permanent and temporary residents. : Citizenship and Immigration Canada; 2013 [cited 2016 July 19th]. Available from: <http://www.cic.gc.ca/english/resources/statistics/facts2013/index.asp>.
9. Immigration and Refugee Protection Act. Government of Canada; 2001.
10. Bragg B. A Guide to Canada's Changing Immigration Policy. Calgary, AB: Ethno-Cultural Council of Calgary., 2013.

- 1
2
3 404 11. deKeyser L, Svedin CG, Agnafors S, Bladh M, Sydsjo G. Multi-informant reports of mental
4
5 405 health in Swedish-born children of immigrants and children born to non-immigrants - the SESBiC-
6
7 406 study. *BMC pediatrics*. 2014;14:95.
8
9 407 12. Huang ZJ, Yu SM, Ledsky R. Health status and health service access and use among
10
11 408 children in U.S. immigrant families. *American journal of public health*. 2006;96(4):634-40.
12
13
14 409 13. Vollebergh WA, ten Have M, Dekovic M, Oosterwegel A, Pels T, Veenstra R, et al. Mental
15
16 410 health in immigrant children in the Netherlands. *Social psychiatry and psychiatric epidemiology*.
17
18 411 2005;40(6):489-96.
19
20
21 412 14. Akhtar-Danesh N, Landeen J. Relation between depression and sociodemographic factors.
22
23 413 *International journal of mental health systems*. 2007;1(1):4.
24
25
26 414 15. Lofors J, Ramirez-Leon V, Sundquist K. Neighbourhood income and anxiety: a study based
27
28 415 on random samples of the Swedish population. *European journal of public health*. 2006;16(6):633-
29
30 416 9.
31
32 417 16. Fazel M, Reed RV, Panter-Brick C, Stein A. Mental health of displaced and refugee
33
34 418 children resettled in high-income countries: risk and protective factors. *The Lancet*.
35
36 419 2012;379(9812):266-82.
37
38
39 420 17. Cantor-Graae E, Pedersen CB. Full spectrum of psychiatric disorders related to foreign
40
41 421 migration: a Danish population-based cohort study. *JAMA psychiatry*. 2013;70(4):427-35.
42
43
44 422 18. Durbin A, Moineddin R, Lin E, Steele LS, Glazier RH. Mental health service use by recent
45
46 423 immigrants from different world regions and by non-immigrants in Ontario, Canada: a cross-
47
48 424 sectional study. *BMC health services research*. 2015;15:336.
49
50
51 425 19. Ivert AK, Merlo J, Svensson R, Levander MT. How are immigrant background and gender
52
53 426 associated with the utilisation of psychiatric care among adolescents? *Soc Psychiatry Psychiatr*
54
55 427 *Epidemiol*. 2013;48(5):693-9.
56
57
58
59
60

- 1
2
3 428 20. Kwak K, Rudmin F. Adolescent health and adaptation in Canada: examination of gender
4
5 429 and age aspects of the healthy immigrant effect. *Int J Equity Health*. 2014;13(1):103.
6
7 430 21. Hansson EK, Tuck A, Lurie S, McKenzie K. Rates of mental illness and suicidality in
8
9 431 immigrant, refugee, ethnocultural, and racialized groups in Canada: a review of the literature.
10
11 432 *Canadian journal of psychiatry Revue canadienne de psychiatrie*. 2012;57(2):111-21.
13
14 433 22. Pietrus M. *Opening Minds Interim Report*. Calgary, AB: Mental Health Commission of
15
16 434 Canada, 2013.
17
18 435 23. Data Dictionary Toronto: Institute for Clinical Evaluative Sciences; [April 11th, 2016].
19
20 436 Available from:
21
22 437 <https://datadictionary.ices.on.ca/Applications/DataDictionary/Library.aspx?Library=CIC>.
23
24 438 24. Ontario Health Insurance Act: Ontario Ministry of Health and Long-Term Care; 2015
25
26 439 [November 13, 2015]. Available from: <http://www.ontario.ca/laws/regulation/900552>.
27
28 440 25. The World Bank Regions 2015 [November 13, 2015]. Available from:
29
30 441 <http://www.worldbank.org/en/about/annual-report/regions>.
31
32 442 26. Steele LS, Glazier RH, Lin E, Evans M. Using administrative data to measure ambulatory
33
34 443 mental health service provision in primary care. *Medical care*. 2004;42(10):960-5.
35
36 444 27. Durbin A, Lin E, Moineddin R, Steele LS, Glazier RH. Use of mental health care for
37
38 445 nonpsychotic conditions by immigrants in different admission classes and by refugees in Ontario,
39
40 446 Canada. *Open Medicine*. 2014;8(4):e136.
41
42 447 28. Huang KY, Calzada E, Cheng S, Brotman LM. Physical and mental health disparities
43
44 448 among young children of Asian immigrants. *The Journal of pediatrics*. 2012;160(2):331-6 e1.
45
46 449 29. Kim IH, Carrasco C, Muntaner C, McKenzie K, Noh S. Ethnicity and postmigration health
47
48 450 trajectory in new immigrants to Canada. *American journal of public health*. 2013;103(4):e96-104.
49
50
51
52
53
54
55
56
57
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59

- 1
2
3 451 30. Durbin A, Moineddin R, Lin E, Steele LS, Glazier RH. Examining the relationship between
4
5 452 neighbourhood deprivation and mental health service use of immigrants in Ontario, Canada: a
6
7 453 cross-sectional study. *BMJ open*. 2015;5(3):e006690.
8
9 454 31. Osypuk TL, Alonso A, Bates LM. Understanding the Healthy Immigrant Effect and
10
11 455 Cardiovascular Disease: Looking to Big Data and Beyond. *Circulation*. 2015;132(16):1522-4.
12
13
14 456 32. Urquia ML, Frank JW, Glazier RH. From places to flows. *International secondary migration*
15
16 457 and birth outcomes. *Social science & medicine*. 2010;71(9):1620-6.
17
18 458 33. Guttman A, Manuel D, Stukel TA, Desmeules M, Cernat G, Glazier RH. Immunization
19
20 459 coverage among young children of urban immigrant mothers: findings from a universal health care
21
22 460 system. *Ambul Pediatr*. 2008;8(3):205-9.
23
24
25 461 34. Open minds, healthy minds: Ontario's Comprehensive Mental Health and Addictions
26
27 462 Strategy.: Government of Ontario; 2011 [cited 2015 November 13th,]. Available from:
28
29 463 http://www.health.gov.on.ca/en/common/ministry/publications/reports/mental_health2011/mentalhe
30
31 464 [alth.aspx](http://www.health.gov.on.ca/en/common/ministry/publications/reports/mental_health2011/mentalhealth.aspx).
32
33
34 465 35. A shared responsibility: Ontario's policy framework for child and youth mental health.:
35
36 466 Ontario Ministry of Children and Youth Services; 2006 [cited 2015 November 13, 2015]. Available
37
38 467 from:
39
40 468 [http://www.children.gov.on.ca/htdocs/English/topics/specialneeds/mentalhealth/sharedresponsibilit](http://www.children.gov.on.ca/htdocs/English/topics/specialneeds/mentalhealth/sharedresponsibility.aspx)
41
42 469 [y.aspx](http://www.children.gov.on.ca/htdocs/English/topics/specialneeds/mentalhealth/sharedresponsibility.aspx).
43
44
45 470 36. Puyat JH. Is the influence of social support on mental health the same for immigrants and
46
47 471 non-immigrants? *Journal of immigrant and minority health / Center for Minority Public Health*.
48
49 472 2013;15(3):598-605.
50
51
52
53
54
55
56
57
58
59
60

1
2
3 473 37. Glazier R, Zagorski B, Rayner J. Comparison of Primary Care Models in Ontario by
4
5 474 Demographics, Case Mix and Emergency Department Use, 2008/09 to 2009/10. ICES Investigative
6
7 475 Report. Toronto: Institute for Clinical Evaluative Sciences, 2012.
8

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Appendix A

Medical record codes used to identify mental health visits to outpatient physicians, emergency departments, and hospitals in Ontario, 1996 to 2012.

Outpatient Mental Health Diagnostic Codes from the Ontario Health Insurance Plan

Any office-based visit to a psychiatrist or any office based visit to a family practitioner or pediatrician with any mental health counselling code or a service code with any of the following diagnoses:

<i>Code</i>	<i>Diagnosis</i>
291	Alcoholic psychosis, delirium tremens, Korsakov's psychosis
292	Drug psychosis
295	Schizophrenia
296	Manic-depressive psychoses, involuntional melancholia
297	Other paranoid states
298	Other psychoses
299	Child Psychoses (e.g. Autism)
300	Anxiety neurosis, hysteria, neurasthenia, obsessive-compulsive neurosis, reactive depression
301	Personality disorders
302	Sexual deviations
303	Alcoholism
304	Drug dependence
305	Tobacco abuse
306	Psychosomatic illness
307	Habit spasms, tics, stuttering, tension headaches, anorexia nervosa, sleep disorders, enuresis
309	Adjustment reaction
311	Depressive disorder
313	Behaviour disorders of childhood and adolescence
314	Hyperkinetic syndrome of childhood
897	Economic problems
898	Marital difficulties
899	Parent-child problems
900	Problems with aged parents or in-laws
901	Family disruption/divorce
902	Education problems
904	Social maladjustment
905	Occupational problems
906	Legal problems
909	Other problems of social adjustment

Mental Health Diagnoses and Codes for Emergency Department Discharges

<u>Year (s)</u>	<u>Codes Type</u>	<u>Variable</u>	<u>Code</u>
2001 – 2002	ICD-9-CA	Main Diagnosis	290 – 319 (except 290.X and 294.X)
OR			
2001 – 2002	ICD-9-CA	Any Diagnosis	E950-E959
2002 - 2012	ICD-10-CA	Main Diagnosis	F04 – F99
OR			
2002 – 2012	ICD-10-CA	Any Diagnosis	X60 - 84

Mental Health Diagnoses and Codes for Mental Health Hospitalizations

Any hospitalization to a designated mental health hospital bed or any hospitalization where:

<u>Year (s)</u>	<u>Codes Type</u>	<u>Variable</u>	<u>Code</u>
1996 – 2002	ICD-9-CA	Most Responsible Diagnosis	290 – 319 (except 290.X and 294.X)
2002-2012	ICD-10-CA	Most Responsible Diagnosis	F04 – F99

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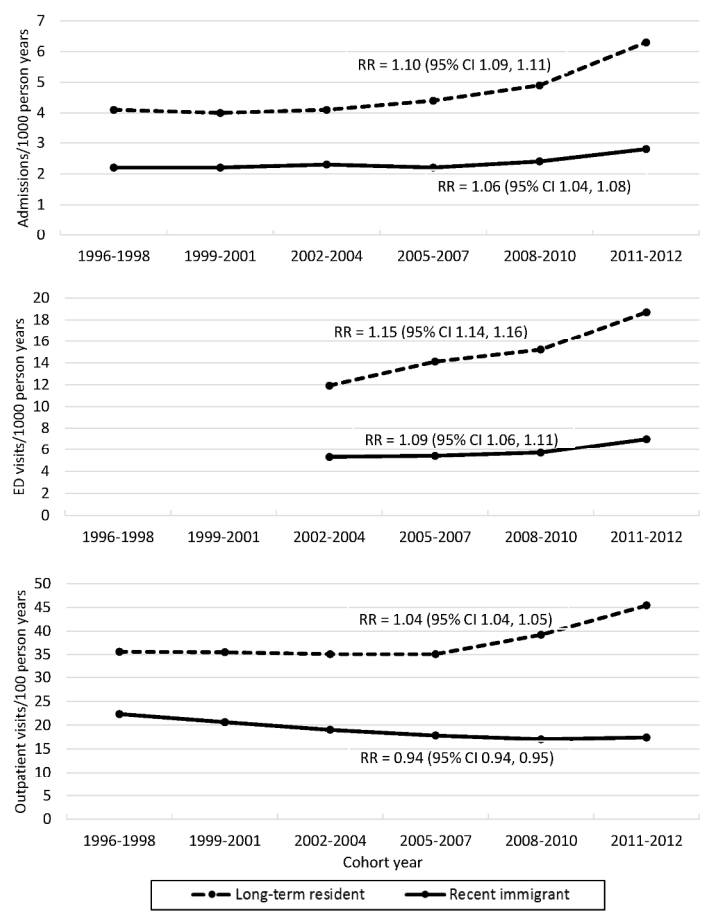


Figure 1. Acute care and outpatient physician visits for mental health problems over time by time period in recent immigrants and long-term residents. (RR) Rate Ratio (CI) Confidence Interval (ED) Emergency Department.

215x279mm (300 x 300 DPI)

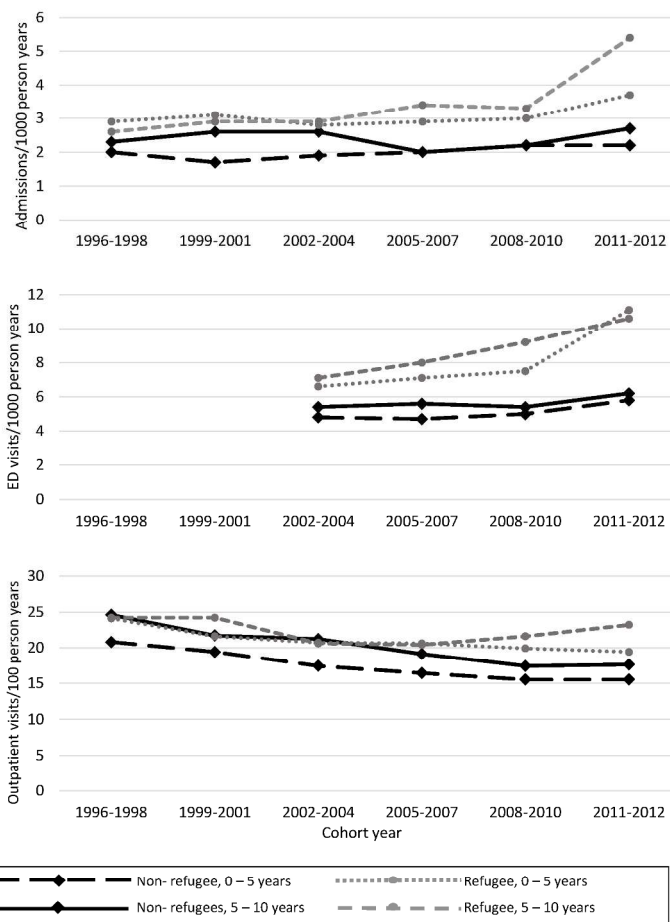


Figure 2. Acute care and outpatient visits for mental health problems over time by time period by immigration class and recency of immigration. (ED) Emergency Department.

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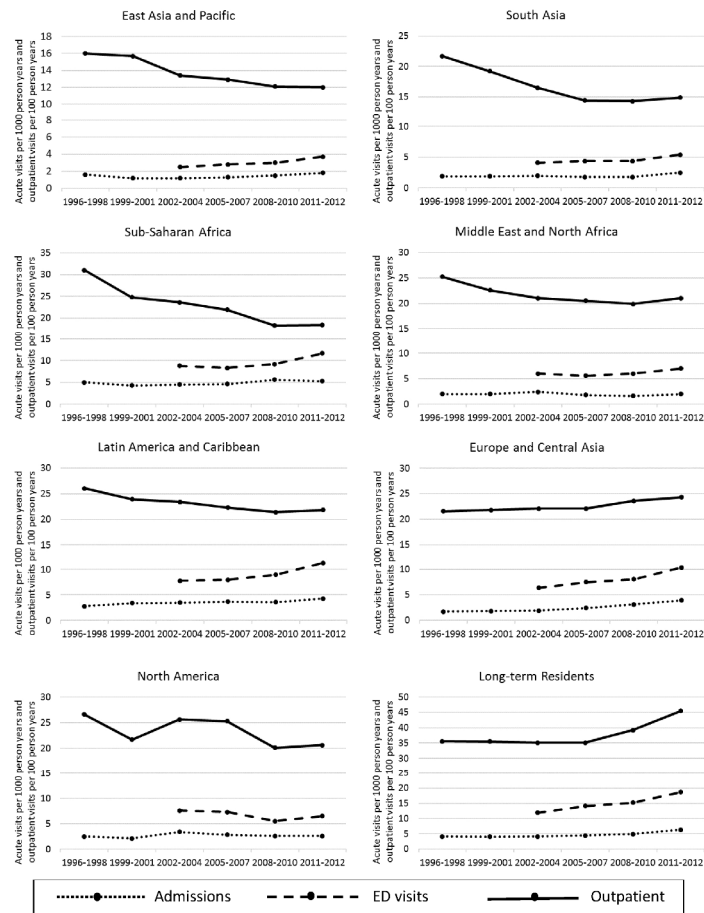


Figure 3. Acute care and outpatient mental health service use by time period and by region of origin. (ED) Emergency Department.

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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
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	Page 1&3	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.	Page 1&3 Page 3 Page 3
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	Page 6&7		
Objectives	3	State specific objectives, including any prespecified hypotheses	Page 7&8		
Methods					
Study Design	4	Present key elements of study design early in the paper	Page 8		
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Page 8		
Participants	6	(a) <i>Cohort study</i> - Give the eligibility	Page 8	RECORD 6.1: The methods of study	Page 8

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 28 29 30 31 32 33 34 35		<p>criteria, and the sources and methods of selection of participants. Describe methods of follow-up</p> <p><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</p> <p><i>Cross-sectional study</i> - Give the eligibility criteria, and the sources and methods of selection of participants</p> <p><i>(b) Cohort study</i> - For matched studies, give matching criteria and number of exposed and unexposed</p> <p><i>Case-control study</i> - For matched studies, give matching criteria and the number of controls per case</p>		<p>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>Page 10</p> <p>N/A</p>	
36 37 38 39 40 41 42 43 44	Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	Page 9&10	<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>	Page 10
45 46 47 48 49 50 51 52 53 54 55 56	Data sources/ measurement	8	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	Page 8		

1 2 3	Bias	9	Describe any efforts to address potential sources of bias	Page 9		
4 5 6 7 8	Study size	10	Explain how the study size was arrived at	N/A – Entire provincial population of children included		
9 10 11 12 13 14 15 16 17	Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	Page 10&11		
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	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	Page 11		
51 52 53 54 55 56 57 58 59 60	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.	Page 2

				RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	Page 9
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.	Page 8
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	Page 11	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.	Page 11
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)	Page 11		
Outcome data	15	<i>Cohort study</i> - Report numbers of outcome	Page 11&12		

1		events or summary			
2		measures over time			
3		<i>Case-control study</i> -			
4		Report numbers in			
5		each exposure			
6		category, or summary			
7		measures of exposure			
8		<i>Cross-sectional study</i>			
9		- Report numbers of			
10		outcome events or			
11		summary measures			
12					
13	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	Page 11, 12 and tables	
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37	Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	Page 12	
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43	Discussion				
44	Key results	18	Summarise key results with reference to study objectives	Page 13	
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48	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	Page 14&15	Page 14&15
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				eligibility over time, as they pertain to the study being reported.	
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Page 13-16		
Generalisability	21	Discuss the generalisability (external validity) of the study results	Page 13		
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	Page 1&2		
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.	Page 1

*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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3 1 Trends in mental health service utilization in immigrant youth in Ontario, Canada, 1996 to 2012: a
4 2 population-based longitudinal cohort study.

5 3
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20 18
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22 20
23 21 **Key words:** pediatrics, immigration, refugee, mental health, access

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42 40 transparent account of the study being reported and no important aspects of the study have been
43 41 omitted. Any discrepancies from the study as planned have been explained.

44 42
45 43 **Data Sharing:** The authors confirm that all data underlying the findings are fully available without
46 44 restriction. Data are available from the Institute for Clinical Evaluative Sciences (ICES)
47 45 Institutional Data Access for researchers who meet the criteria for access to confidential data.

1
2
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4 47 but the presented data are anonymized and risk of identification is low.
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9 52 study, interpreted the results, revised the manuscript, and approved the final manuscript as
10 53 submitted. H. Lu conceptualized and designed the study, had access to and analysed the data,
11 54 interpreted the results, revised the manuscript, and approved the final manuscript as submitted. All
12 55 authors approved the final manuscript as submitted and agree to be accountable for all aspects of
13 56 the work.
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3 65 **Abstract**

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5 66 **Objective:** To describe trends in mental health service use of youth by immigration status and
6
7 67 characteristics.

8
9 68 **Design:** Population-based longitudinal cohort study from 1996 to 2012 using linked health and
10
11 69 administrative datasets.

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13
14 70 **Setting:** Ontario, Canada.

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16 71 **Participants:** Youth 10 to 24 years, living in Ontario, Canada

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18 72 **Exposure.** The main exposure was immigration status (recent immigrants vs. long-term residents).
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20
21 73 Secondary exposures were region of origin and refugee status.

22
23 74 **Main Outcome Measure:** Mental health hospitalizations, emergency department visits, and
24
25 75 outpatient visits within consecutive 3-year time periods. Poisson regression models estimated rate
26
27 76 ratios (RR).

28
29
30 77 **Results:** Over 2.5 million person years per period were included. Rates of recent immigrant mental
31
32 78 health service utilization were at least 40% lower than long-term residents ($p<0.0001$). Mental
33
34 79 health hospitalization and emergency department visit rates increased in long-term residents
35
36 80 (hospitalizations, RR 1.09 (95% confidence intervals 1.08-1.09); emergency department visits, RR
37
38 81 1.15 (1.14-1.15)) and recent immigrants (hospitalizations RR 1.05 (1.03-1.07); emergency
39
40 82 department visits, RR 1.08 (1.05-1.11)). Mental health outpatient visit rates increased in long-term
41
42 83 residents (RR 1.03 (1.03-1.03)) but declined in recent immigrant (RR 0.94 (0.93-0.95)).

43
44 84 Comparable divergent trends in acute care and outpatient service use were observed among
45
46 85 refugees and across most regions of origin. Recent immigrant acute care use was driven by longer-
47
48 86 term refugees (hospitalizations RR 1.12; (1.03-1.21); emergency department visits RR 1.11 (1.02-
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50 87 1.20)).
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3 88 **Conclusions:** Mental health service utilization was lower among recent immigrants than long-term
4
5 89 residents. While acute care use is increasing at a faster rate among long-term residents than recent
6
7 90 immigrants, the decrease in outpatient mental health visits in immigrants highlights a potential
8
9 91 emerging disparity in access to preventative care.
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12 92 **Trial Registration:** Not Applicable.
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3 96 **Strengths and Limitations of this Study:**
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- 5 97 • This is first population-based study to evaluate trends over time in mental health service use
6
7 98 in immigrant youth in Canada and the largest such study globally.
8
9 99 • Using individual linked health and demographic databases, we were able to obtain health
10
11 services use for a broad range of mental health disorders in a large population of youth.
12 100
13
14 101 • The immigration database allowed a detailed level of information about immigration
15
16 102 characteristics and is also distinguished from other mental health studies among immigrants
17
18 103 which are often survey based, self-reported (and therefore under-reported) and have smaller
19
20 104 sample sizes.
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22
23 105 • Limitations include absence of information on mental health need, social support and
24
25 106 informal use of mental health services (e.g. religious leaders, social workers, community
26
27 107 support networks).
28
29
30 108 • Data on psychologist, social work, and community mental health agency use are not
31
32 109 currently available for linking.
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111 **Introduction**

112 Mental health problems among youth contribute to significant morbidity and mortality across the
113 globe, affecting one in five individuals.(1, 2) Recent population-based data suggests the burden of
114 mental health problems among youth in Ontario, Canada is rising,(1) as is mental health service use
115 in North America.(3, 4) Understanding trends over time in the utilization of mental health services
116 is critical for optimal health service delivery. Accordingly, to make appropriately targeted health
117 system improvements, identifying mental health trends in at-risk populations, including the growing
118 population of immigrant youth, is important. This is increasingly becoming essential on an
119 international scale given global migration and the current refugee crisis. Immigrants may face
120 challenges integrating pre-migration social, cultural, and political experiences and post-migration
121 resettlement stressors with their new lives as permanent residents or naturalized citizens. These
122 experiences influence the complex set of factors that shape an immigrant's ability to access health
123 services and their risk for mental health and addiction problems before, upon, and after arrival.(5-7)
124 In Canada, approximately 20% of the population are 'landed immigrants' or 'permanent residents'
125 (granted permission to live and work in Canada without limitations on one's stay). Of these, 85 to
126 90% are skilled and educated workers, arriving as non-refugees.(8) Over the past two decades,
127 shifts in immigration patterns to Canada have occurred. In particular, in recent years, there has
128 been a relative increase in migration of South and East Asian populations with a simultaneous
129 decline in immigrants from Eastern Europe and Central Asia.(8) These shifts are, in part, reflective
130 of changes to Canadian immigration policy over time(9, 10) and indicative of changing drivers of
131 global migration including political instability, economic opportunity, and family reunification.
132 Changes to pre- and post-immigration exposures that may influence mental health service need,
133 utilization, and access may accompany these variations in migration.

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3 134 Existing literature on the epidemiology of mental health problems in immigrant youth is
4
5 135 inconsistent and typically based on smaller sub-sets of immigrants, most of which, rely on self-
6
7 136 report.(5, 6, 11-13) Social deprivation, common among immigrants, is often cited as a risk factor
8
9 137 for mental health problems(14, 15) but protective immigration factors may counter this risk.(16)
10
11
12 138 One Danish population-based, administrative database study(17) showed higher rates of mental
13
14 139 health problems in immigrants compared with non-immigrants. This is in contrast to other
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16 140 population-based North American and other European studies in both adolescents and adults where
17
18 141 there is a more pronounced 'healthy immigrant effect' – that is, individuals arrive in better health,
19
20 142 with lower rates of mental health problems, than their native-born counterparts.(7, 18, 19) This
21
22 143 may be due to differences in immigration policies in receiving countries that select for healthier,
23
24 144 more able-bodied individuals. Literature on the mental health of immigrant youth in Canada is
25
26 145 limited to a few small survey studies that suggest lower rates of mental health problems among
27
28 146 immigrants.(20, 21)
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31
32 147 Despite the substantial proportion of health services concentrated on mental health care and
33
34 148 Canada's large and evolving immigrant population, little is known about the how mental health
35
36 149 service use has changed over time in immigrants. In this study, we aimed to describe the time trends
37
38 150 in mental health service utilization in recent immigrant youth in Ontario compared with long-term
39
40 151 residents. We also sought to describe these time trends among sub-groups of immigrants, including
41
42 152 by immigrant class, duration of residency in Canada, and region of origin. We hypothesized that
43
44 153 overall, immigrants would have lower utilization of the health care system for mental health
45
46 154 compared with long-term residents. However, we expected increasing rates of use in both recent
47
48 155 and long-term residents given widespread efforts in more recent years to reduce mental health
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50 156 stigma and improve help-seeking behaviours.(22) We hypothesize that refugees, in particular,
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3 157 would have an increasing trend in mental health use given the changes over time in Canada's
4
5 158 immigration policies that have shifted refugee selection to more at-risk populations.(9, 10)
6

7 159 **Methods**

8 9 160 *Study Design*

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11
12 161 This was a population-based longitudinal study using data available through a research agreement
13
14 162 between the Ontario Ministry of Health and Long-Term Care and the Institute for Clinical
15
16 163 Evaluative Sciences (ICES). The study was approved by the Research Ethics Board at Sunnybrook
17
18 164 Health Sciences Centre in Toronto, Ontario.

19 165 *Patient Involvement*

20
21
22 166 Patients were not directly involved in this study.

23 167 *Data Collection*

24
25
26 168 Youth were identified using a unique, encoded, health identification number that linked several
27
28 169 health and administrative databases available at ICES to obtain study data. Immigrant status was
29
30 170 ascertained through the Ontario portion of the Immigration, Refugees and Citizenship Canada
31
32 171 (IRCC) Permanent Resident Database. The IRCC database contains individual level demographic
33
34 172 information from Ontario's permanent residents from 1985 to 2012.(9, 18) A number of
35
36 173 immigration characteristics were used from the database including immigrant visa class (refugee
37
38 174 versus non-refugee), duration of residence in Canada (based on the earlier of year of obtaining
39
40 175 permanent residency in Canada or the year of Ontario Health Insurance Plan (OHIP) eligibility),
41
42 176 and World Bank region of origin (based on the country of birth). The Registered Persons Database,
43
44 177 Ontario's universal health insurance registry, was used to obtain age and sex for every OHIP
45
46 178 eligible individual meeting study criteria. Emergency department (ED) visits were obtained
47
48 179 through the National Ambulatory Care Reporting System (NACRS) (2002-2012) and hospital
49
50 180 admissions were identified from the Canadian Institute for Health Information Discharge Abstract
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3 181 Database (CIHI-DAD) (1996-2012) and from the Ontario Mental Health Reporting System
4
5 182 (OMHRS) (2005-2012). To determine outpatient service use to physicians, mental health visits to
6
7 183 primary care physicians and psychiatrist outpatient visits were determined from the OHIP billings
8
9 184 database (1996-2012). In Ontario, residents are eligible for most hospital and physician services
10
11 185 through OHIP which acts as a single payer for the province. Immigrants with permanent resident
12
13 186 status are eligible if they have resided in Ontario for three months. Refugees with permanent
14
15 187 resident status may obtain OHIP coverage upon arrival.(23) Data from asylum-seekers (those
16
17 188 arriving in Canada and subsequently seeking refugee status) are not captured in the available
18
19 189 databases. Statistics Canada's Postal Code Conversion File was used to link patients' postal code at
20
21 190 the time of the visit to derive area level neighborhood income quintile and community size from the
22
23 191 1996, 2001, and 2006 Canadian Censuses.

28 192 *Study population*

29
30 193 All youth ages 10 to 24 years who were eligible for OHIP during the study period from 1996 to
31
32 194 2012 were included. Cohorts were grouped into 3-year periods, except for the final two study
33
34 195 years, which were grouped as a 2-year period. Youth entered the study upon their 10th birthday and
35
36 196 exited on their 25th birthday. Those with an invalid encoded health number or missing sex were
37
38 197 excluded from the study. Non-Ontario residents at the onset of the study cohort period were also
39
40 198 excluded. Finally, individuals without an IRCC record (Canadian born or immigrants who moved
41
42 199 to Ontario from another province) who first became eligible for OHIP within 5 years of each cohort
43
44 200 period were excluded to reduce the possibility of unlinked IRCC records inappropriately being
45
46 201 included as Canadian born.

51 202 *Exposure variables*

52
53 203 The main exposure was immigrant status, categorized as recent immigrant or long-term resident.
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55 204 Recent immigrants were defined based on having an IRCC Permanent Resident Database record
56
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3 205 and a duration of residence in Ontario < 10 years. Long-term residents included all Canadian born
4
5 206 Ontario residents and individuals with an IRCC Permanent Resident Database record who had
6
7 207 landed in Canada ≥ 10 years from the start of the cohort period. Immigrant status was determined at
8
9 208 the beginning of each period. Thus, recent immigrants in one period could become long-term
10
11 209 residents in a subsequent period, so long as they maintained OHIP eligibility and study age criteria.
12
13

14 210 *Covariates*

15
16 211 A number of covariates were considered in the analysis. These included age, sex, neighborhood
17
18 212 income quintile within a dissemination area, and community size. Within recent immigrants,
19
20 213 covariates also included refugee status, duration of residency in Ontario (< 5 years and ≥ 5 to 10
21
22 214 years), region of origin based on modified World Bank Regions,(24) and the interaction between
23
24 215 duration of residency and refugee status, and between time with refugee status, duration of
25
26 216 residency, and region of birth.
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30 217 *Outcome measures*

31
32 218 The main outcome measure was mental health service utilization, within each time period.
33
34 219 Utilization was measured as all outpatient physician visits, ED visits and hospitalizations for a
35
36 220 mental health related problem. Outpatient physician mental health visits were identified using
37
38 221 OHIP billing codes and included visits to psychiatrists and visits to family physicians or
39
40 222 pediatricians where billing codes for mental health services or visits with a mental health diagnostic
41
42 223 code were used. This definition was based on a validated algorithm for ambulatory mental health
43
44 224 care modified by adding specific pediatric diagnostic codes.(25) These billings do not include
45
46 225 services provided by psychologists, social workers, and community-based non-physician mental
47
48 226 health services. ED visits were identified within NACRS where the main ED diagnosis was a
49
50 227 mental health disorder (F04-F99) or a secondary diagnosis was for self-inflicted injury (intentional
51
52 228 self-harm, X60-X84), both based on International Classification of Disease 9th and 10th edition
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3 229 codes. Similarly, hospitalizations were identified as any hospitalization with a mental health
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5 230 diagnostic code (F04-F99) captured in CIHI-DAD or any hospitalization to a provincially
6
7 231 designated mental health hospital bed identified within OMHRS, except for admissions for
8
9 232 dementia. See Appendix A for codes used to identify mental health visits.

11 233 *Analysis*

13
14 234 The total number of individuals, person years of exposure, and number and rate of events for each
15
16 235 cohort period were estimated. An unadjusted time trend for each outcome by immigrant status was
17
18 236 estimated. The interaction between immigrant status and time was tested and where significant,
19
20 237 separate slopes for each exposure group were presented. A subgroup analysis on recent immigrants
21
22 238 was then performed to estimate an adjusted time trend for recent immigrant subgroups by region of
23
24 239 origin, refugee status, and duration of residence. The unit of analysis was the individual resident.
25
26 240 Multivariable models were built for each outcome, adjusting for age, sex, income quintile, and
27
28 241 community size. All analyses were estimated using Poisson regression with Generalized Estimating
29
30 242 Equations using an independent correlation structure for outpatient and ED visits and autoregressive
31
32 243 correlation structure for hospitalizations. Results are presented as rate ratios (RR). Analyses were
33
34 244 conducted with SAS Enterprise Guide, version 6.1 (SAS Institute Inc., Cary, NC).

35 245 **Results**

36
37 246 Approximately 2.5 to 2.9 million individuals contributed to each time period. Supplementary Figure
38
39 247 1 shows a flow chart of a sample of a cohort period with exclusions applied. Recent immigrants
40
41 248 made up 9.8 to 11.5% of the cohort in each cohort period and refugees represented 17.7 to 18.0% of
42
43 249 recent immigrants. The regions of origin changed over time, initially with Europe and Central Asia
44
45 250 as the leading regions, and more recently South and East Asia (Table I).

46
47 251 Figure 1 shows the unadjusted time trends in rates of mental health service utilization in recent
48
49 252 immigrants and long-term residents. Mental health service utilization was much lower for
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3 253 outpatient physician and acute care services in recent immigrants compared with long-term
4
5 254 residents (all rate ratios ≤ 0.60 , $p < 0.001$) (Table II). Both ED visits and hospitalizations rates
6
7 255 increased over time in recent immigrants and long-term residents but the increase in rates was
8
9 256 higher in long-term residents (Table II). Rates of outpatient physician visits for mental health
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11 257 increased over time in long-term residents but decreased over time in recent immigrants (Table II).
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14 258 Low income and female sex were associated with an increased rate of mental health service use.
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16 259 Late childhood and early adolescence was associated with a lower rate of mental health service use.
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18 260 Urban individuals had the lowest rate of being admitted to hospital and the highest rate of using
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20 261 outpatient physician mental health services.
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23 262 Within subgroups of immigrants, refugees had higher rates of ED visits and hospitalizations
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25 263 compared with non-refugee recent immigrants and the recent increase in ED service use was driven
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27 264 by refugees (Figure 2, Table III). The increase in hospitalization rates for mental health was
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29 265 influenced primarily by refugees with a duration of residence of 5 to 10 years in Canada (Table III).
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31 266 Trends in outpatient physician visit rates among recent immigrants were similar by refugee status
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33 267 and duration of residence in Canada (Figure 2, Table III).
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35 268 The unadjusted rates of mental health outpatient and ED visits and hospitalizations by region of
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37 269 origin are shown in Figure 3 with adjusted rates in Table III. Across all regions, except Europe,
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39 270 Central Asia, and North America, there were convergent trends in outpatient and acute care service
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41 271 use for mental health conditions, with outpatient service use declining and acute care service use
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43 272 increasing over time.
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49 273 **Discussion**

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51 274 This large population-based longitudinal study examined mental health service use over time in
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53 275 recent immigrants and long-term residents in Ontario. Patterns of mental health service use over
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55 276 time were consistently lower for outpatient physician and acute care mental health services by
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3 277 recent immigrants compared with long-term residents. Rates of acute care mental health service use
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5 278 increased over time in both groups but at a faster rate in long-term residents. Strikingly, outpatient
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7 279 physician mental health service use increased over time in long-term residents but decreased in
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9 280 recent immigrant groups. These discordant trends in outpatient and acute care mental health service
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11 281 use were observed across both refugees and non-refugee immigrants and in immigrants from most
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14 282 world regions.

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16 283 Lower rates of mental health services use by immigrants have also been observed in other large
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18 284 population-based cross-sectional studies of Canadian adults(18, 26) and in smaller cohort studies
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20 285 across the globe (27), though not consistently(17, 28) For example, adolescents living in Sweden
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22 286 with foreign-born parents were less likely than adolescents with Swedish parents to use both
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25 287 outpatient and inpatient psychiatric services. This was particularly true for those whose families
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27 288 originated in low or middle income countries.(19) Refugees in Denmark have lower rates of
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29 289 psychiatric service contacts compared with their native born peers.(29) The variability in reported
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31 290 differences between mental health burden in immigrant and native populations may be due to
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33 291 differences in immigration policies in receiving countries. Some have attributed better mental
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35 292 health in immigrant populations to selective migration for healthier individuals.(30, 31) This
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37 293 'healthy immigrant effect' has been observed for a number of adult conditions(32) but for few
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39 294 pediatric diseases(33, 34) and, to our knowledge, has not been demonstrated in Canadian refugee
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42 295 youth. Lower rates of mental health service use may be due to different care-seeking behaviours,
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44 296 with poor self-identification of mental health problems or more internalizing problems in immigrant
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47 297 populations.(20, 27)

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51 298 In both recent immigrants and long-term residents, we found increases in ED visits and
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53 299 hospitalizations over time. Similar trends among youth have been reported in the United States(3)
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55 300 and Australia.(35) This may be a reflection of greater awareness and acceptance of mental health

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3 301 problems in recent years from reduced stigma,(22) or formal strategies to improve access to mental
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5 302 health services in the last several years in Ontario.(36, 37) The differential rates of increase in acute
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7 303 care service use in these populations may be that strategies to improve mental health services and
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9 304 reduce mental health stigma are not reaching all populations, in particular recent immigrant youth.
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11 305 The increasing rate over time in acute care service use by refugees highlights the importance of the
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13 306 vulnerability of this population and the need for active surveillance of individuals, especially with
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15 307 the current global refugee crisis and changes to immigration policies that select for a larger number
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17 308 of more vulnerable refugees.(9)
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19 309 The divergent trends in outpatient physician service use over time between study groups signals
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21 310 emerging differences in health service delivery for recent immigrants. This may be a reflection of
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23 311 different access to or availability of outpatient physician care or increasing stigma of mild mental
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25 312 health problems among immigrants with consequent internalization of mental health problems.
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27 313 Moreover, there may be a lack of familiarity with mental health services in certain immigrant
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29 314 populations. For example, while Swedish immigrant youth have lower rates of mental health
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31 315 utilization compared with non-immigrants,(19) their rates of self-reported, parent-reported and
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33 316 teacher-reported mental health problems are similar to non-immigrants(28), suggesting a potential
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35 317 unmet need in service delivery. Similarly, despite high rates of mental distress, refugee children in
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37 318 Denmark use fewer psychiatric services and therefore may experience barriers to access and care
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39 319 for mental health.(29) Conversely, these finding may signify immigrants are increasingly receiving
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41 320 alternative, non-physician mental health services though school-based programs, community mental
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43 321 health service agencies, or psychologists. The observed regional differences in outpatient trends,
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45 322 with 'Western' regions having more similar trends to long-term Canadian residents, suggests
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47 323 cultural congruency may be contributing to the observed findings. Equally, the observed
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49 324 differences may be explained by a heavier reliance on informal supports from strong familial and
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3 325 social networks in immigrant populations.(38) This latter notion could enhance strategies to
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5 326 improve the mental health of high use populations, including those who are native-born.

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7 327 *Strengths and Limitations*

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9 328 To our knowledge, this is the first study to evaluate trends over time in mental health service use in
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11 329 immigrant youth in Canada and the largest such study globally. Using individual linked health and
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13 330 demographic databases, we were able to obtain health services use for a broad range of mental
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15 331 health disorders in a large population of youth. We had almost complete provincial data with
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17 332 virtually no loss of individual records. The immigration database allowed a detailed level of
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19 333 information about immigration characteristics. This study is also distinguished from other mental
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21 334 health studies among immigrants which are often survey based, self-reported (and therefore under-
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23 335 reported), have smaller sample sizes, and are largely focused on adults.

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26 336 Limitations to this study include absence of information on mental health need, social support and
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28 337 informal use of mental health services (e.g. religious leaders, social workers, community support
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30 338 networks). Data on psychologist, social work, and community mental health agency use are not
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32 339 currently available for linking. These data would help contextualize our findings and allow us to
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34 340 understand whether observed divergent trends are related to difficulty accessing physician care or
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36 341 rather, determine if there are differential treatment-seeking behaviours by recent immigrants. Our
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38 342 definition of mental health hospitalization did not include the small number of hospitalizations for
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40 343 self-injury where there may have been co-existing mental illness but the injury itself was the
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42 344 diagnosis most responsible for the length of stay. Our study did not include measures of clinical
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44 345 comorbidities which may affect mental health service use. We did not have available primary care
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46 346 data from community health centres which traditionally serve a higher proportion of immigrants
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48 347 and marginalized populations.(39) However, community health centres in Ontario serve less than
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50 348 1% of the population, of which 16% are newcomers.(39) In this study, we were not able to track
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3 349 immigrants who entered Ontario from a different province, refugee claimants awaiting a decision
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5 350 on residency, temporary residents, or 'non-status' residents. Finally, differential self-perceived
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7 351 mental health status and cultural incongruence may lead to mis-diagnosis and therefore under-
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9 352 reporting of mental health problems, by health care providers.

11 353 **Conclusions**

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14 354 This large population-based longitudinal study of youth showed mental health acute care services
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16 355 are increasing over time in recent immigrant and long-term resident populations. However, there is
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18 356 an increasing difference in outpatient mental health service use with mental health outpatient
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20 357 physician visits decreasing in recent immigrant populations, despite an increased acute care service
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22 358 use over time. Future studies are needed to understand why these service differences exists to
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24 359 ensure recent immigrants in need of mental health services are identified and able to access needed
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26 360 care. Understanding whether divergent trends reflect difficulty accessing physician mental health
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28 361 care or whether alternative models of mental health service delivery are serving these populations is
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30 362 important. Development of strategies to reduce potential inequities in access and use with an active
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32 363 effort to clarify the role of mental health services for recent immigrants are essential to ensuring
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34 364 equity in the provision of mental health service for all youth.
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Table I. OHIP eligible youth by period in Ontario

	1996 to 1998	1999 to 2001	2002 to 2004	2005 to 2007	2008 to 2010	2011 to 2012
Overall, N	2521439	2692524	2824820	2929879	2887553	2714188
Immigrant Status, %						
Long-term residents	88.7	88.7	88.6	88.5	88.7	90.2
Recent immigrants	11.3	11.3	11.4	11.5	11.3	9.8
Age at Index (Years), %						
10-14	45.6	46.1	45.7	44.5	43.4	38.9
15-19	27.0	27.4	27.9	28.3	28.8	30.9
20-24	27.4	26.4	26.3	27.2	27.9	30.2
Sex						
Female	49.1	49.0	49.0	49	48.9	48.8
Male	50.9	51.0	51.0	51	51.5	51.2
Income Quintile, %						
Income missing	0.3	0.5	0.4	0.4	0.4	0.4
Income quintile 1 (lowest)	20.0	20.5	20.0	21.0	20.0	19.4
Income quintile 2	19.3	19.9	19.6	19.7	19.3	18.9
Income quintile 3	19.8	19.8	19.8	19.4	19.7	19.8
Income quintile 4	20.3	19.4	20.0	19.5	20.4	20.9
Income quintile 5	20.3	20.0	20.1	20.0	20.3	20.5
Community Size, %						
1 500 000+	45.9	40.5	41.6	42.5	43.3	43.7
500 000 – 1 499 999	5.6	12.1	12.1	12.1	12.2	12.3
100 000 – 499 999	23.9	24.0	24.0	25.1	25.1	25.2
10 000 – 99 999	9.1	9.6	9.2	8.2	7.8	7.6
< 10 000	15.6	13.8	13.2	12	11.5	11.2
Immigration characteristics						
N	284150	304991	322173	337163	326556	265061
Refugee Status, %						
Non-refugee, 0-5 years	58.5	54.7	53.7	55.4	49.4	41.5
Non-refugee, ≥5-10 years	23.8	27.5	28.4	26.9	32.6	39.9
Refugees, 0-5 years	12.4	11.1	12.5	12.7	12.5	11.2
Refugees, ≥5-10 years	5.3	6.6	5.4	5.0	5.5	7.5
Region of Birth, %						
East Asia & Pacific	22.1	21.4	21.6	22.9	23.6	24.7
Europe & C. Asia	23.4	22.0	18.3	15.8	14.0	11.6
L.A. & Caribbean	18.5	15.3	13.4	11.5	11.4	11.5
Mid East & N. Africa	9.2	10.5	11.4	12.5	13.2	14.3
North America	2.0	1.9	2.0	2.3	2.9	3.4
South Asia	17.7	21.7	26.0	28.2	28.1	27.4
Sub-Saharan Africa	7.1	7.0	7.2	6.8	6.8	7.1

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Table II. Multivariable Poisson regression models for rates of mental health hospitalizations, emergency department visits and outpatient physician visits by immigration status and over time.

	Hospitalizations	Emergency department visits	Outpatient physician visits
Parameter	RR (95% CI)	RR (95% CI)	RR (95% CI)
Immigration Status (Reference: Long-term residents)			
Recent immigrants	0.60 (0.56, 0.64)	0.49 (0.47, 0.52)	0.60 (0.59, 0.61)
Relative change per time period (Reference period 1996-1998 for hospitalizations and outpatient visits, 2002-2004 for emergency department visits)			
Time trend – Recent immigrant	1.05 (1.03, 1.07)	1.08 (1.05, 1.11)	0.94 (0.93, 0.95)
Time trend – Long-term resident	1.09 (1.08, 1.09)	1.15 (1.14, 1.15)	1.03 (1.03, 1.03)
Sex (Reference: female)			
Male	0.89 (0.87, 0.91)	0.80 (0.79, 0.82)	0.85 (0.84, 0.85)
Age (Reference: 20 to 24 years)			
Age: 10 to 14 years	0.52 (0.51, 0.53)	0.43 (0.43, 0.44)	0.49 (0.48, 0.49)
Age: 15 to 19 years	0.99 (0.98, 1.01)	1.11 (1.09, 1.12)	0.75 (0.74, 0.75)
Income (Reference quintile 5)			
Income missing	1.98 (1.78, 2.21)	2.12 (1.97, 2.29)	1.05 (0.99, 1.12)
Income quintile 1 (lowest)	1.36 (1.32, 1.40)	1.62 (1.59, 1.65)	1.03 (1.02, 1.04)
Income quintile 2	1.19 (1.16, 1.22)	1.32 (1.30, 1.35)	0.95 (0.94, 0.96)
Income quintile 3	1.08 (1.05, 1.11)	1.16 (1.13, 1.18)	0.91 (0.90, 0.92)
Income quintile 4	1.04 (1.01, 1.07)	1.07 (1.05, 1.09)	0.90 (0.89, 0.91)
Community size (Reference: 1 500 000+)			
500 000 – 1 499 999	0.95 (0.92, 0.99)	1.46 (1.42, 1.50)	1.09 (1.08, 1.10)
100 000 – 499 999	1.33 (1.30, 1.36)	1.60 (1.57, 1.63)	1.03 (1.03, 1.04)
10 000 – 99 999	1.55 (1.50, 1.60)	1.98 (1.94, 2.03)	0.94 (0.93, 0.96)
< 10 000	1.23 (1.19, 1.27)	1.81 (1.77, 1.84)	0.74 (0.74, 0.76)

RR adjusted for immigration status, time, sex, age, neighbourhood income quintile, and community size.

Table III. Multivariable Poisson regression models for time trends in mental health hospitalizations, emergency department visits, and outpatient physician visits within recent immigrant groups.

	Hospitalizations	Emergency department visits	Outpatient physician visits
Parameter	RR (95% CI)	RR (95% CI)	RR (95% CI)
Immigration Class			
Non-refugees, 0 to 5 years	1.04 (1.01, 1.07)	1.04 (1.00, 1.07)	0.93 (0.92, 0.94)
Non-refugees, ≥5 to 10 years	1.01 (0.97, 1.05)	1.05 (1.01, 1.10)	0.93 (0.92, 0.94)
Refugees, 0 to 5 years	1.02 (0.97, 1.08)	1.14 (1.07, 1.22)	0.95 (0.93, 0.96)
Refugees, ≥5 to 10 years	1.12 (1.03, 1.21)	1.11 (1.02, 1.20)	0.95 (0.93, 0.97)
Region of Origin			
East Asia and Pacific	1.02 (0.97, 1.07)	1.10 (1.04, 1.17)	0.93 (0.92, 0.94)
South Asia	1.05 (1.00, 1.11)	1.08 (1.02, 1.14)	0.92 (0.91, 0.94)
Sub-Saharan Africa	1.04 (0.97, 1.11)	1.10 (1.00, 1.20)	0.89 (0.87, 0.91)
Middle East and North Africa	0.98 (0.91, 1.05)	1.05 (0.98, 1.11)	0.96 (0.94, 0.98)
Latin America and Caribbean	1.08 (1.03, 1.13)	1.12 (1.06, 1.18)	0.95 (0.94, 0.97)
Europe and Central Asia	1.17 (1.11, 1.24)	1.16 (1.10, 1.22)	1.01 (0.99, 1.03)
North America	1.00 (0.89, 1.14)	0.92 (0.76, 1.13)	0.96 (0.91, 1.01)
Long-term Residents	1.09 (1.08, 1.09)	1.15 (1.14, 1.15)	1.03 (1.03, 1.03)

RR;s for immigration class adjusted for immigration class, time, sex, age, neighbourhood income quintile, and community size. RR's for region of origin adjusted for region of origin, time, sex, age, neighbourhood income quintile, and community size.

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3 376 **Figure 1.** Acute care and outpatient physician visits for mental health problems over time by time
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5 377 period in recent immigrants and long-term residents. (RR) Rate Ratio (CI) Confidence Interval
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7 378 (ED) Emergency Department.
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12 380 **Figure 2.** Acute care and outpatient visits for mental health problems over time by time period by
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14 381 immigration class and recency of immigration. (ED) Emergency Department.
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19 383 **Figure 3.** Acute care and outpatient mental health service use by time period and by region of
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21 384 origin. (ED) Emergency Department.
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27 386 **Supplementary Figure 1.** Flow chart detailing an example of the application of the inclusion and
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29 387 exclusion criteria for the 2011 and 2012 cohort period.
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3 392 **Abbreviations:**

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5 393 (CI) Confidence interval; (CIHI-DAD) Canadian Institute for Health Information Discharge

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7 394 Abstract Database; (ED) Emergency department; (ICES) Institute for Clinical Evaluative Sciences;

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9 395 (IRCC) Immigration, Refugees and Citizenship Canada; (LTR) Long-term resident; (NACRS)

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11 396 National Ambulatory Care Reporting System; (OHIP) Ontario Health Insurance Plan; (OMHRS)

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14 397 Ontario Mental Health Reporting System; (RI) Recent immigrants; (RR) Rate ratio.

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For peer review only

References

1. The Mental Health of Children and Youth in Ontario: A Baseline Scorecard. Toronto, ON: Institute for Clinical Evaluative Sciences, 2015.
2. Waddell C, Shepherd CA, Schwartz C, Barican J. Child and Youth Mental Disorders: Prevalence and Evidence-Based Interventions. Vancouver, BC: Children's Health Policy Centre, British Columbia Ministry of Children and Family Development, 2014.
3. Mapelli E, Black T, Doan Q. Trends in Pediatric Emergency Department Utilization for Mental Health-Related Visits. *The Journal of pediatrics*. 2015;167(4):905-10.
4. Olfson M, Druss BG, Marcus SC. Trends in mental health care among children and adolescents. *N Engl J Med*. 2015;372(21):2029-38.
5. Beiser M, Goodwill AM, Albanese P, McShane K, Nowakowski M. Predictors of immigrant children's mental health in Canada: selection, settlement contingencies, culture, or all of the above? *Social psychiatry and psychiatric epidemiology*. 2014;49(5):743-56.
6. Beiser M, Zilber N, Simich L, Youngmann R, Zohar AH, Taa B, et al. Regional effects on the mental health of immigrant children: results from the New Canadian Children and Youth Study (NCCYS). *Health & place*. 2011;17(3):822-9.
7. Beiser M, Hou F, Hyman I, Tousignant M. Poverty, family process, and the mental health of immigrant children in Canada. *American journal of public health*. 2002;92(2):220-7.
8. Facts and figures 2013. Immigration overview – permanent and temporary residents. : Immigration, Refugees and Citizenship Canada; 2013 [cited 2016 July 19th]. Available from: <http://www.cic.gc.ca/english/resources/statistics/facts2013/index.asp>.
9. Immigration and Refugee Protection Act. Government of Canada; 2001.
10. Bragg B. A Guide to Canada's Changing Immigration Policy. Calgary, AB: Ethno-Cultural Council of Calgary., 2013.

- 1
2
3 423 11. deKeyser L, Svedin CG, Agnafors S, Bladh M, Sydsjo G. Multi-informant reports of mental
4
5 424 health in Swedish-born children of immigrants and children born to non-immigrants - the SESBiC-
6
7 425 study. *BMC pediatrics*. 2014;14:95.
8
9 426 12. Huang ZJ, Yu SM, Ledsky R. Health status and health service access and use among
10
11 427 children in U.S. immigrant families. *American journal of public health*. 2006;96(4):634-40.
12
13
14 428 13. Vollebergh WA, ten Have M, Dekovic M, Oosterwegel A, Pels T, Veenstra R, et al. Mental
15
16 429 health in immigrant children in the Netherlands. *Social psychiatry and psychiatric epidemiology*.
17
18 430 2005;40(6):489-96.
19
20
21 431 14. Akhtar-Danesh N, Landeen J. Relation between depression and sociodemographic factors.
22
23 432 *International journal of mental health systems*. 2007;1(1):4.
24
25
26 433 15. Lofors J, Ramirez-Leon V, Sundquist K. Neighbourhood income and anxiety: a study based
27
28 434 on random samples of the Swedish population. *European journal of public health*. 2006;16(6):633-
29
30 435 9.
31
32 436 16. Fazel M, Reed RV, Panter-Brick C, Stein A. Mental health of displaced and refugee
33
34 437 children resettled in high-income countries: risk and protective factors. *The Lancet*.
35
36 438 2012;379(9812):266-82.
37
38
39 439 17. Cantor-Graae E, Pedersen CB. Full spectrum of psychiatric disorders related to foreign
40
41 440 migration: a Danish population-based cohort study. *JAMA psychiatry*. 2013;70(4):427-35.
42
43
44 441 18. Durbin A, Moineddin R, Lin E, Steele LS, Glazier RH. Mental health service use by recent
45
46 442 immigrants from different world regions and by non-immigrants in Ontario, Canada: a cross-
47
48 443 sectional study. *BMC health services research*. 2015;15:336.
49
50
51 444 19. Ivert AK, Merlo J, Svensson R, Levander MT. How are immigrant background and gender
52
53 445 associated with the utilisation of psychiatric care among adolescents? *Social psychiatry and*
54
55 446 *psychiatric epidemiology*. 2013;48(5):693-9.
56
57
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2
3 447 20. Kwak K, Rudmin F. Adolescent health and adaptation in Canada: examination of gender
4
5 448 and age aspects of the healthy immigrant effect. *International journal for equity in health*.
6
7 449 2014;13(1):103.
8
9 450 21. Hansson EK, Tuck A, Lurie S, McKenzie K. Rates of mental illness and suicidality in
10
11 451 immigrant, refugee, ethnocultural, and racialized groups in Canada: a review of the literature.
12
13 452 *Canadian journal of psychiatry Revue canadienne de psychiatrie*. 2012;57(2):111-21.
14
15 453 22. Pietrus M. *Opening Minds Interim Report*. Calgary, AB: Mental Health Commission of
16
17 454 Canada, 2013.
18
19 455 23. Ontario Health Insurance Act: Ontario Ministry of Health and Long-Term Care; 2015
20
21 456 [November 13, 2015]. Available from: <http://www.ontario.ca/laws/regulation/900552>.
22
23 457 24. The World Bank Regions 2015 [November 13, 2015]. Available from:
24
25 458 <http://www.worldbank.org/en/about/annual-report/regions>.
26
27 459 25. Steele LS, Glazier RH, Lin E, Evans M. Using administrative data to measure ambulatory
28
29 460 mental health service provision in primary care. *Medical care*. 2004;42(10):960-5.
30
31 461 26. Durbin A, Lin E, Moineddin R, Steele LS, Glazier RH. Use of mental health care for
32
33 462 nonpsychotic conditions by immigrants in different admission classes and by refugees in Ontario,
34
35 463 Canada. *Open Medicine*. 2014;8(4):e136.
36
37 464 27. Huang KY, Calzada E, Cheng S, Brotman LM. Physical and mental health disparities
38
39 465 among young children of Asian immigrants. *The Journal of pediatrics*. 2012;160(2):331-6 e1.
40
41 466 28. Dekeyser L, Svedin CG, Agnafors S, Sydsjo G. Self-reported mental health in 12-year-old
42
43 467 second-generation immigrant children in Sweden. *Nordic journal of psychiatry*. 2011;65(6):389-95.
44
45 468 29. Barghadouch A, Kristiansen M, Jervelund SS, Hjern A, Montgomery E, Norredam M.
46
47 469 Refugee children have fewer contacts to psychiatric healthcare services: an analysis of a subset of
48
49
50
51
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57
58
59
60

- 1
2
3 470 refugee children compared to Danish-born peers. *Social psychiatry and psychiatric epidemiology*.
4
5 471 2016;51(8):1125-36.
6
7 472 30. Kim IH, Carrasco C, Muntaner C, McKenzie K, Noh S. Ethnicity and postmigration health
8
9 473 trajectory in new immigrants to Canada. *American journal of public health*. 2013;103(4):e96-104.
10
11 474 31. Durbin A, Moineddin R, Lin E, Steele LS, Glazier RH. Examining the relationship between
12
13 475 neighbourhood deprivation and mental health service use of immigrants in Ontario, Canada: a
14
15 476 cross-sectional study. *BMJ open*. 2015;5(3):e006690.
16
17
18 477 32. Osypuk TL, Alonso A, Bates LM. Understanding the Healthy Immigrant Effect and
19
20 478 Cardiovascular Disease: Looking to Big Data and Beyond. *Circulation*. 2015;132(16):1522-4.
21
22
23 479 33. Urquia ML, Frank JW, Glazier RH. From places to flows. *International secondary migration*
24
25 480 and birth outcomes. *Social science & medicine*. 2010;71(9):1620-6.
26
27
28 481 34. Guttman A, Manuel D, Stukel TA, Desmeules M, Cernat G, Glazier RH. Immunization
29
30 482 coverage among young children of urban immigrant mothers: findings from a universal health care
31
32 483 system. *Ambul Pediatr*. 2008;8(3):205-9.
33
34
35 484 35. Perera J, Wand T, Bein KJ, Chalkley D, Ivers R, Steinbeck KS, et al. Presentations to NSW
36
37 485 emergency departments with self-harm, suicidal ideation, or intentional poisoning, 2010-2014. *The*
38
39 486 *Medical journal of Australia*. 2018;208(8):348-53.
40
41
42 487 36. Open minds, healthy minds: Ontario's Comprehensive Mental Health and Addictions
43
44 488 Strategy.: Government of Ontario; 2011 [cited 2015 November 13th,]. Available from:
45
46 489 http://www.health.gov.on.ca/en/common/ministry/publications/reports/mental_health2011/mentalhe
47
48 490 [alth.aspx](http://www.health.gov.on.ca/en/common/ministry/publications/reports/mental_health2011/mentalhealth.aspx).
49
50
51 491 37. A shared responsibility: Ontario's policy framework for child and youth mental health.:
52
53 492 Ontario Ministry of Children and Youth Services; 2006 [cited 2015 November 13, 2015]. Available
54
55 493 from:

1
2
3 494 <http://www.children.gov.on.ca/htdocs/English/topics/specialneeds/mentalhealth/sharedresponsibilit>
4
5 495 [y.aspx](#).

6
7 496 38. Puyat JH. Is the influence of social support on mental health the same for immigrants and
8
9 497 non-immigrants? Journal of immigrant and minority health / Center for Minority Public Health.
10
11 498 2013;15(3):598-605.

12
13
14 499 39. Glazier R, Zagorski B, Rayner J. Comparison of Primary Care Models in Ontario by
15
16 500 Demographics, Case Mix and Emergency Department Use, 2008/09 to 2009/10. ICES Investigative
17
18 501 Report. Toronto: Institute for Clinical Evaluative Sciences, 2012.

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22 502
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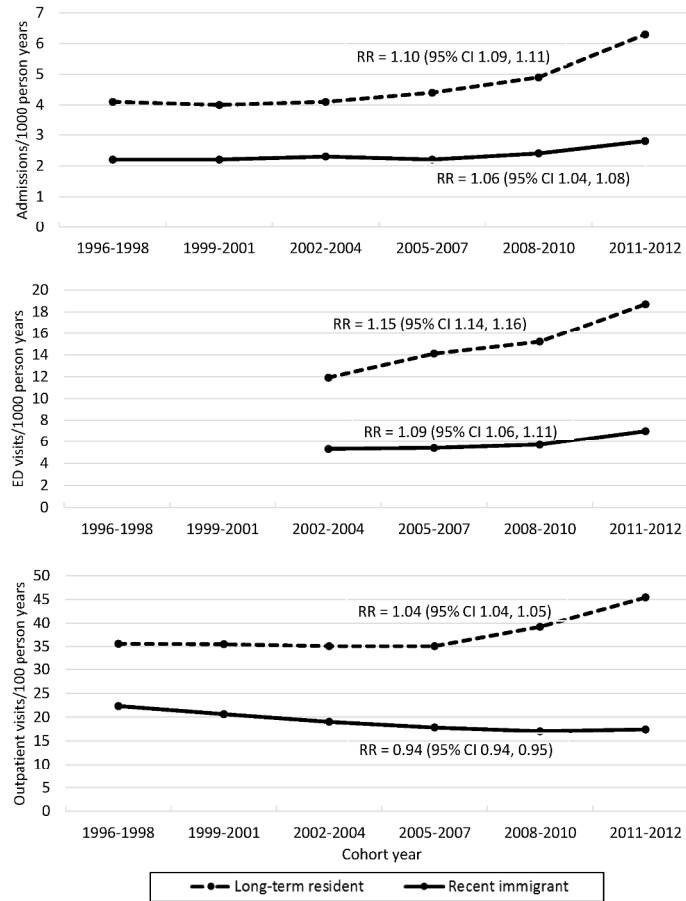


Figure 1. Acute care and outpatient physician visits for mental health problems over time by time period in recent immigrants and long-term residents. (RR) Rate Ratio (CI) Confidence Interval (ED) Emergency Department.

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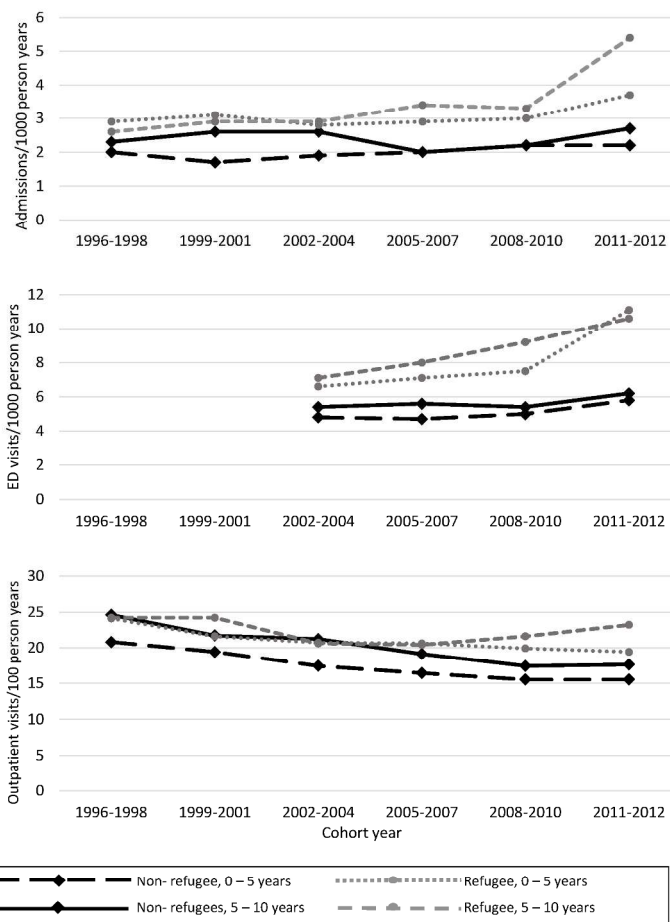


Figure 2. Acute care and outpatient visits for mental health problems over time by time period by immigration class and recency of immigration. (ED) Emergency Department.

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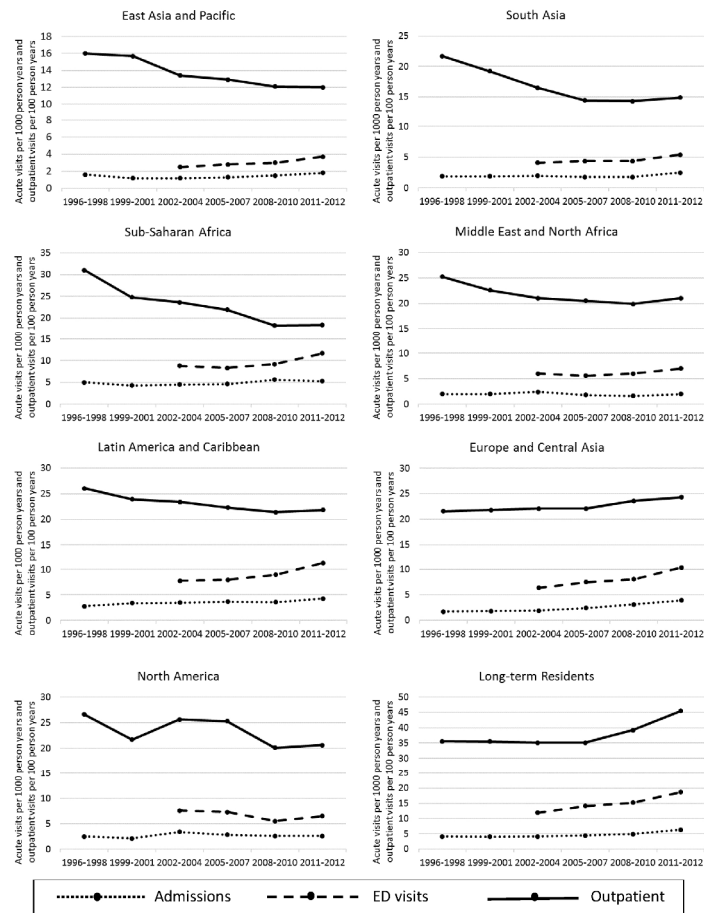
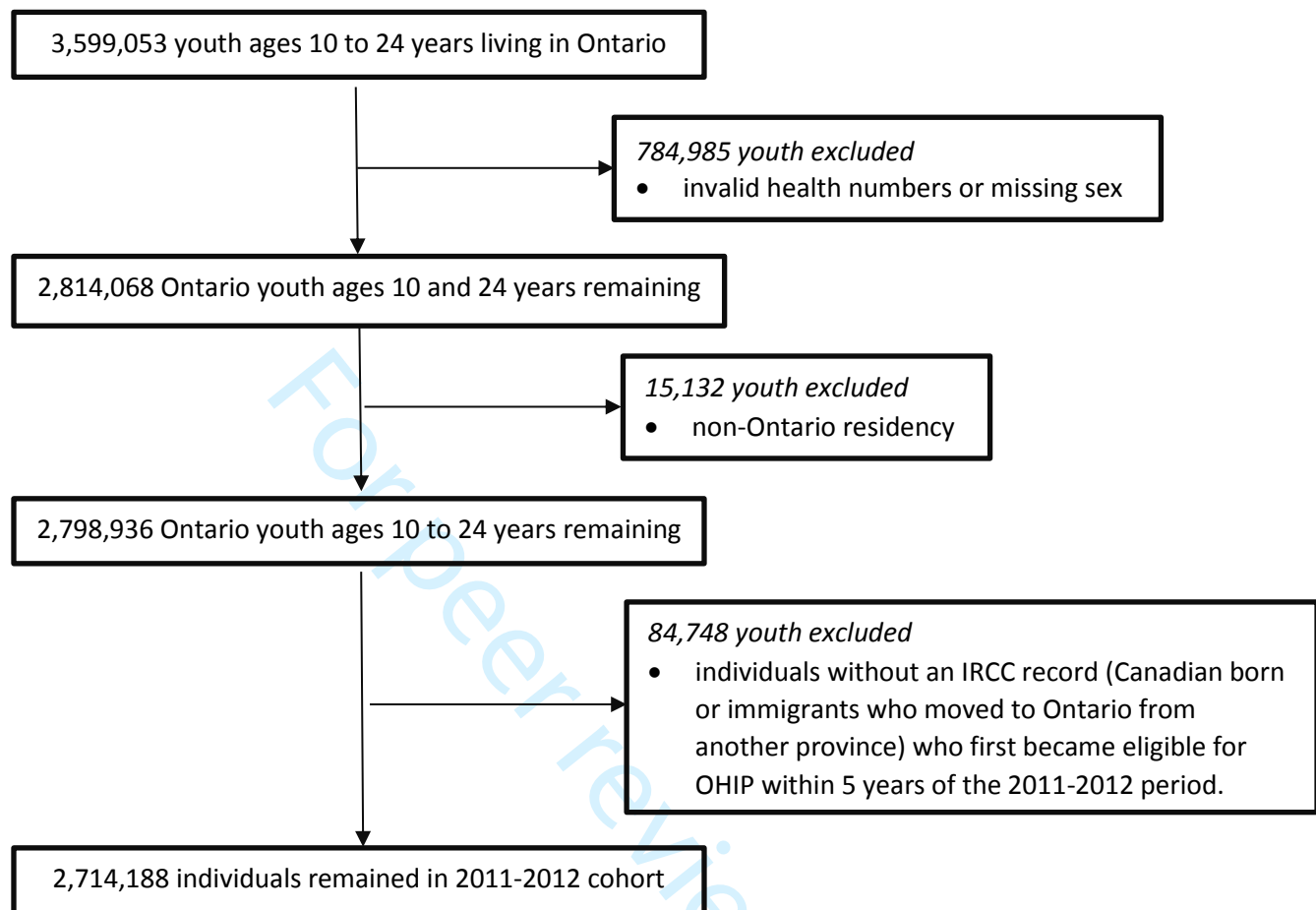


Figure 3. Acute care and outpatient mental health service use by time period and by region of origin. (ED) Emergency Department.

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Supplementary Figure 1.

Appendix A

Medical record codes used to identify mental health visits to outpatient physicians, emergency departments, and hospitals in Ontario, 1996 to 2012.

Outpatient Mental Health Diagnostic Codes from the Ontario Health Insurance Plan

Any office-based visit to a psychiatrist or any office based visit to a family practitioner or pediatrician with any mental health counselling code or a service code with any of the following diagnoses:

<i>Code</i>	<i>Diagnosis</i>
291	Alcoholic psychosis, delirium tremens, Korsakov's psychosis
292	Drug psychosis
295	Schizophrenia
296	Manic-depressive psychoses, involuntional melancholia
297	Other paranoid states
298	Other psychoses
299	Child Psychoses (e.g. Autism)
300	Anxiety neurosis, hysteria, neurasthenia, obsessive-compulsive neurosis, reactive depression
301	Personality disorders
302	Sexual deviations
303	Alcoholism
304	Drug dependence
305	Tobacco abuse
306	Psychosomatic illness
307	Habit spasms, tics, stuttering, tension headaches, anorexia nervosa, sleep disorders, enuresis
309	Adjustment reaction
311	Depressive disorder
313	Behaviour disorders of childhood and adolescence
314	Hyperkinetic syndrome of childhood
897	Economic problems
898	Marital difficulties
899	Parent-child problems
900	Problems with aged parents or in-laws
901	Family disruption/divorce
902	Education problems
904	Social maladjustment
905	Occupational problems
906	Legal problems
909	Other problems of social adjustment

Mental Health Diagnoses and Codes for Emergency Department Discharges

<u>Year (s)</u>	<u>Codes Type</u>	<u>Variable</u>	<u>Code</u>
2001 – 2002	ICD-9-CA	Main Diagnosis	290 – 319 (except 290.X and 294.X)
OR			
2001 – 2002	ICD-9-CA	Any Diagnosis	E950-E959
2002 - 2012	ICD-10-CA	Main Diagnosis	F04 – F99
OR			
2002 – 2012	ICD-10-CA	Any Diagnosis	X60 - 84

Mental Health Diagnoses and Codes for Mental Health Hospitalizations

Any hospitalization to a designated mental health hospital bed or any hospitalization where:

<u>Year (s)</u>	<u>Codes Type</u>	<u>Variable</u>	<u>Code</u>
1996 – 2002	ICD-9-CA	Most Responsible Diagnosis	290 – 319 (except 290.X and 294.X)
2002-2012	ICD-10-CA	Most Responsible Diagnosis	F04 – F99

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
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	Page 1&3	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.	Page 1&3 Page 3 Page 3
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	Page 6&7		
Objectives	3	State specific objectives, including any prespecified hypotheses	Page 7&8		
Methods					
Study Design	4	Present key elements of study design early in the paper	Page 8		
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Page 8		
Participants	6	(a) <i>Cohort study</i> - Give the eligibility	Page 8	RECORD 6.1: The methods of study	Page 8

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 28 29 30 31 32 33 34 35		<p>criteria, and the sources and methods of selection of participants. Describe methods of follow-up</p> <p><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</p> <p><i>Cross-sectional study</i> - Give the eligibility criteria, and the sources and methods of selection of participants</p> <p><i>(b) Cohort study</i> - For matched studies, give matching criteria and number of exposed and unexposed</p> <p><i>Case-control study</i> - For matched studies, give matching criteria and the number of controls per case</p>		<p>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>Page 10</p> <p>N/A</p>	
36 37 38 39 40 41 42 43 44	Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	Page 9&10	<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>	Page 10
45 46 47 48 49 50 51 52 53 54 55 56	Data sources/ measurement	8	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	Page 8		

1 2 3	Bias	9	Describe any efforts to address potential sources of bias	Page 9		
4 5 6 7 8	Study size	10	Explain how the study size was arrived at	N/A – Entire provincial population of children included		
9 10 11 12 13 14 15 16 17	Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	Page 10&11		
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50	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	Page 11		
51 52 53 54 55 56 57 58 59	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.	Page 2

				RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	Page 9
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.	Page 8
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	Page 11	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.	Page 11
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)	Page 11		
Outcome data	15	<i>Cohort study</i> - Report numbers of outcome	Page 11&12		

		events or summary measures over time <i>Case-control study</i> - Report numbers in each exposure 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	Page 11, 12 and tables		
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	Page 12		
Discussion					
Key results	18	Summarise key results with reference to study objectives	Page 13		
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	Page 14&15	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	Page 14&15

				eligibility over time, as they pertain to the study being reported.	
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Page 13-16		
Generalisability	21	Discuss the generalisability (external validity) of the study results	Page 13		
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	Page 1&2		
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.	Page 1

*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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