Supplement Table 1 – Data Elements Indicative of Homelessness, Supportive Housing or Shelter Use

Database	Variable Name	Indicator Value	Description
DAD	HOMELESS	"Y"	Homelessness indicator
	INSTTYPE	"SH"	Institution Type = Supportive Housing
	DX10CODE1 to DX10CODE25	"Z590" or "Z591"	ICD-10 diagnosis codes for "Homelessness" and "Inadequate housing"
	CMGDIAG	"Z590" or "Z591"	ICD-10 diagnosis codes for "Homelessness" and "Inadequate housing"
	PSTLCODE	"XX"	Used to indicate transient/homeless patients
NACRS	DX10CODE1 to DX10CODE10	"Z590" or "Z591"	ICD-10 diagnosis codes for "Homelessness" and "Inadequate housing"
	RESTYPE	"3" or "4"	Residence Type = "Homeless" or "Shelter"
	PSTLCODE	"XX"	Used to indicate transient/homeless patients
OMHRS	PREDX10CODE to PREDX10CODE11	"Z590" or "Z591"	ICD-10 diagnosis codes for "Homelessness" and "Inadequate housing"
	POSTDX10CODE1 to POSTDX10CODE24	"Z590" or "Z591"	ICD-10 diagnosis codes for "Homelessness" and "Inadequate housing"
	PRIOR_RESIDENCE	"6"	Prior residential status = "Homeless (with or without shelter)"
	USUAL_RESIDENCE	"8"	Usual residential status = "Homeless (with or without shelter)"
	ADMITFROM	"8"	Admitted from = "Homeless (with or without shelter)"
	DISCHLIVING	"8"	Living arrangement at discharge = "Homeless (with or without shelter)"
	P5_Retired_2009	"6"	(Variable retired in 2009) Living arrangement = "Homeless (with or without shelter)"
	PSTLCODE	"XX"	Used to indicate transient/homeless patients
HCD	DXCODE	"V600" or "V601"	ICD-9 diagnosis codes for "Lack of housing" or "Inadequate housing"
	REQUEST_PROGRAM	"6"	Program Requested = "Supportive Housing"
	RESIDENCE_TYPE	"1604", "2200" or "3400"	Residence Type = "Other Supportive Living Unit", "Hostel/Shelter" or "No fixed address"
RAICA	B4	"8"	Expected residential/living status during service provision = "Homeless (with / without shelter)"
NRS	ALIVESET	"6"	Admission living setting = "Shelter"
	FLIVESET	"6"	Follow-up living setting = "Shelter"

Database	Variable Name	Indicator Value	Description
	PRIM_DISCH_WAIT_REASON	"1.1"	Primary Discharge Wait Reason = "Assisted Living/Supportive Housing"
	SECND_DISCH_WAIT_REASON	"1.1"	Secondary Discharge Wait Reason = "Assisted Living/Supportive Housing"
CORR	PROVINCE_CODE	"XX"	"Transient/Homeless"
	HEALTH_CARD_PROVINCE_CODE	"XX"	"Transient/Homeless"

ICD=International Classification of Diseases

Supplement Table 2: Description of Case Ascertainment Algorithms

Name	Data Sources included[1]	Time Interval	Case Positive Condition(s)
1 indicator +/- 0 days	DAD NACRS OMHRS CORR RAICA HCD NRS	0 days before the encounter start or after the encounter end	1 positive ("homeless") indicator[2] in any of the included sources within the specified time frame
1 indicator +/- 15 days	DAD NACRS OMHRS CORR RAICA HCD NRS	15 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included sources within the specified time frame
1 indicator +/- 45 days	DAD NACRS OMHRS CORR RAICA HCD NRS	45 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included sources within the specified time frame
1 indicator +/- 90 days	DAD NACRS OMHRS CORR RAICA HCD NRS	90 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included sources within the specified time frame
1 indicator +/- 180 days	DAD NACRS OMHRS CORR RAICA HCD NRS	180 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included sources within the specified time frame

Name	Data Sources included[1]	Time Interval	Case Positive Condition(s)
1 indicator OR postal code +/- 0 days	DAD NACRS OMHRS CORR RAICA HCD NRS ICES PSTLYEAR	0 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included health encounter sources or ICES PSTLYEAR-matched facilities providing shelter services.
1 indicator OR postal code +/- 15 days	DAD NACRS OMHRS CORR RAICA HCD NRS ICES PSTLYEAR	15 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included health encounter sources or ICES PSTLYEAR-matched facilities providing shelter services.
1 indicator OR postal code +/- 45 days	DAD NACRS OMHRS CORR RAICA HCD NRS ICES PSTLYEAR	45 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included health encounter sources or ICES PSTLYEAR-matched facilities providing shelter services.
1 indicator OR postal code +/- 90 days	DAD NACRS OMHRS CORR RAICA HCD NRS ICES PSTLYEAR	90 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included health encounter sources or ICES PSTLYEAR-matched facilities providing shelter services.

Name	Data Sources included[1]	Time Interval	Case Positive Condition(s)
1 indicator OR postal code +/- 180 days	DAD NACRS OMHRS CORR RAICA HCD NRS ICES PSTLYEAR	180 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included health encounter sources or ICES PSTLYEAR-matched facilities providing shelter services.
1 CIHI indicator +/- 0 days	DAD NACRS OMHRS	0 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included sources within the specified time frame
1 CIHI indicator +/- 15 days	DAD NACRS OMHRS	15 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included sources within the specified time frame
1 CIHI indicator +/- 45 days	DAD NACRS OMHRS	45 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included sources within the specified time frame
1 CIHI indicator +/- 90 days	DAD NACRS OMHRS	90 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included sources within the specified time frame
1 CIHI indicator +/- 180 days	DAD NACRS OMHRS ICES PSTLYEAR	180 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included sources within the specified time frame
1 CIHI indicator OR postal code +/- 0 days	DAD NACRS OMHRS ICES PSTLYEAR	0 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included health encounter sources or ICES PSTLYEAR-matched facilities providing shelter services.
1 CIHI indicator OR postal code +/- 15 days	DAD NACRS OMHRS ICES PSTLYEAR	15 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included health encounter sources or ICES PSTLYEAR-matched facilities providing shelter services.

Name	Data Sources included[1]	Time Interval	Case Positive Condition(s)
1 CIHI indicator OR postal code +/- 45 days	DAD NACRS OMHRS ICES PSTLYEAR	45 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included health encounter sources or ICES PSTLYEAR-matched facilities providing shelter services.
1 CIHI indicator OR postal code +/- 90 days	DAD NACRS OMHRS ICES PSTLYEAR	90 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included health encounter sources or ICES PSTLYEAR-matched facilities providing shelter services.
1 CIHI indicator OR postal code +/- 180 days	DAD NACRS OMHRS ICES PSTLYEAR	180 days before the encounter start or after the encounter end	1 positive ("homeless") indicator in any of the included health encounter sources or ICES PSTLYEAR-matched facilities providing shelter services.

1. Data sources are named and described in Supplement Table 3
2. indicators in each data sources are presented in Supplement Table 1

Supplement Table 3: Databases Used

Name	Data Source	Description
Health and Housing in Transition Study	Primary data collection	A longitudinal study conducted from 2009-2014 in three Canadian cities (Toronto, Ontario; Ottawa, Ontario; and Vancouver, British Columbia) aiming to assess the impact of housing transitions on health. Participants were randomly selected at shelters, meal programmes, community health centres, drop-in centres, rooming houses, and single-room occupancy hotels from January to December 2009 and were interviewed every 12 months. Data on housing status were initially classified into one of 25 types of residence, which were then further classified into one of three mutually exclusive residence categories: housed, institution or homeless. To determine if periods of time spent in institutions (e.g. hospitals, prison, etc.) should be considered periods of homelessness or housing, housing status prior and subsequent to the period of institutionalization were reviewed, and institution housing episodes flanked by any period of homelessness was also considered homelessness.
Canadian Institute for Health Information Discharge Abstract Database (DAD)	Canadian Institute for Health Information (CIHI)	The DAD contains administrative, clinical (diagnoses and procedures/interventions), demographic, and administrative information for all admissions to acute care hospitals in Ontario. At ICES, consecutive DAD records are linked together to form 'episodes of care' among the hospitals to which patients have been transferred after their initial admission
Ontario Mental Health Reporting System (OMHRS)	Canadian Institute for Health Information (CIHI)	The OMHRS contains administrative, clinical (diagnoses and procedures), demographic, and administrative information for all admissions to adult designated inpatient mental health beds. This includes beds in general hospitals, provincial psychiatric facilities, and specialty psychiatric facilities. Clinical assessment data is ascertained using the Resident Assessment Instrument for Mental Health (RAI-MH), but different amounts of information are collected using this instrument depending on the length of stay in the mental health bed. Multiple assessments may occur during the length of a mental health admission.
National Ambulatory Care Reporting System (NACRS)	Canadian Institute for Health Information (CIHI)	The NACRS contains administrative, clinical (diagnoses and procedures), demographic, and administrative information for all patient visits made to hospital- and community-based ambulatory care centres (emergency departments, day surgery units, hemodialysis units, and cancer care clinics) in Ontario. At ICES, NACRS records are linked with other data sources (DAD, Ontario Mental Health Reporting System [OMHRS]) to identify transitions to other care settings, such as inpatient acute care or psychiatric care.

Name	Data Source	Description
Home Care Database (HCD)	Ontario Association of Community Care Access Centres	The Home Care Database contains administrative data about the patients, episodes, and services who receive home care through CCACs. The data included here is extracted from the CCAC administrative data system (CHRIS).
Resident Assessment Instrument Contact Assessment Database (RAICA)	Ontario Association of Community Care Access Centres	The interRAIContact Assessment (interRAICA) is a short screening assessment completed for adults at the time of intake to CCAC service (i.e. home care and / or palliative care) from community or hospital (including ED). It was designed to support decision-making about the urgency for immediate service provision, record essential clinical information on persons who would not be receiving comprehensive assessment at a later stage, and provide the minimum clinical information to enable short-term services to be put in place before completion of a full RAI assessment (ie. RAI-HC)
National Rehabilitation Reporting System (NRS)	Ministry of Health and Long-Term Care	The National Rehabilitation Reporting System (NRS) contains client data collected from participating adult inpatient rehabilitation facilities and programs across Canada. Data elements include socio-demographic information, administrative data, patient health characteristics, activities and participation and interventions.
Canadian Organ Replacement Registry (CORR)	Canadian Institute for Health Information (CIHI)	The Ontario portion of the Canadian Organ Replacement Register (CORR) records activity and outcomes of vital organ transplantation and renal dialysis activities.
ICES-derived PSTLYEAR database	ICES; Ministry of Health and Long-Term Care	The ICES-derived PSTLYEAR database contains the best known postal code for persons in the OHIP Registered Persons Database on July 1st of each year starting from year 1991. Postal codes supplied by the Ministry of Health and Long-Term Care are enriched with information in CIHI and other ICES-housed datasets to take advantage of the postal code information recorded each time an individual accesses certain healthcare services.
OHIP Registered Persons Database	Ministry of Health and Long-Term Care	The OHIP RPDB provides basic demographic information (age, sex, location of residence, date of birth, and date of death for deceased individuals) for those issued an Ontario health insurance number. The RPDB also indicates the time periods for which an individual was eligible to receive publicly funded health insurance benefits and provides the best known postal code for each registrant on July 1st of each year.

Name	Data Source	Description
Ontario Health Insurance Plan (OHIP)	Ministry of Health and Long-Term Care	The OHIP claims database contains information on inpatient and outpatient services provided to Ontario residents eligible for the province's publicly funded health insurance system by fee-for-service health care practitioners (primarily physicians) and "shadow billings" for those paid through non-fee-for-service payment plans. Billing codes on the claims (OHIP fee codes) identify the care provider, their area of specialization and the type and location of service. OHIP billing claims also contain a 3-digit diagnosis code - the main reason for the service - captured using a modified version of the ICD, 8th revision coding system.
Immigration, Refugees, and Citizenship Canada's Permanent Resident database (IRCC)	Immigration, Refugees and Citizenship Canada	The Ontario portion of the IRCC Permanent Resident Database includes immigration application records for people who initially applied to land in Ontario since 1985. The dataset contains permanent residents' demographic information such as country of citizenship, level of education, mother tongue, and landing date. New immigrants who are currently residing in Ontario but originally landed in another province are not captured in this dataset.

Name	Data Source	Description
Ontario COPD Database (COPD)	Canadian Institute for Health Information (CIHI)	The Ontario COPD Database is created using two separate algorithms applied to inpatient hospitalization (DAD), same day surgery (SDS) records, and physician billing claims (OHIP) data to determine the diagnosis date for incident cases of chronic obstructive pulmonary disease in Ontario. In an algorithm which maximizes sensitivity, the definition for COPD is any physician billing claim with a diagnosis for COPD (OHIP diagnosis codes: 491, 492, 496) or any inpatient hospitalization or same day surgery record with a diagnosis for COPD (ICD-9 diagnosis codes: 491, 492, 496; ICD-10 diagnosis codes: J41- J44; in any diagnostic code space). When using expert panel review of primary care charts as the reference standard, this definition has been shown to have the following performance characteristics: Sensitivity (85.0%), Specificity (78.4%), Positive Predictive Value (57.5%), and Negative Predictive Value (93.8%).(7) In an algorithm which maximizes specificity, the definition for COPD is ≥3 physician billing claims with a diagnosis for COPD (OHIP diagnosis codes: 491, 492, 496) or ≥1 inpatient hospitalization or same day surgery record with a diagnosis for COPD (ICD-9 diagnosis codes: 491, 492, 496; ICD-10 diagnosis codes: J41, J42, J43, J44; in any diagnostic code space) in a two-year period. When using expert panel review of primary care charts as the reference standard, this definition has been shown to have the following performance characteristics: Sensitivity (57.5%), Specificity (95.4%), Positive Predictive Value (81.3%), and Negative Predictive Value (86.7%).(1)
Ontario Diabetes Database (ODD)	Canadian Institute for Health Information (CIHI)	The ODD is created using algorithms applied to inpatient hospitalization (DAD) records, same day surgery (SDS) records, and physician billing claims (OHIP) data to determine the diagnosis date for incident cases of diabetes in Ontario. For adults aged 19 years and greater, the definition for diabetes is 2 physician billing claims with a diagnosis for diabetes (OHIP diagnosis code: 250) or 1 inpatient hospitalization or same day surgery record with a diagnosis for diabetes (ICD-9 diagnosis code: 250; ICD-10 diagnosis codes: E10, E11, E13, E14; in any diagnostic code space) within a 2 year period. Physician claims and hospitalizations with a diagnosis of diabetes occurring within 120 prior to and 180 days after a gestational hospitalization record were excluded. When using primary care chart abstraction as the reference standard, this definition has been shown to have the following performance characteristics: Sensitivity (86.1%), Specificity (97.1%), Positive Predictive Value (79.8%), and Negative Predictive Value (98.1%).(2)

Name	Data Source	Description
Ontario CHF Database (CHF)	Canadian Institute for Health Information (CIHI)	The Ontario CHF Database is created using a definition of ≥2 physician billing claims with a diagnosis of congestive heart failure (OHIP diagnosis code: 428) and/or ≥1 inpatient hospitalization or same day surgery record with a diagnosis of congestive heart failure (ICD-9 diagnosis code: 428; ICD-10 diagnosis code: I50; in the primary diagnostic code space) in a two-year period applied to hospitalization (DAD), same day surgery (SDS), and physician billing claims (OHIP) data to determine the diagnosis date for incident cases of CHF in Ontario. When using electronic medical record data abstraction as the reference standard, the above definition has been demonstrated to have the following performance characteristics: Sensitivity (84.8%), Specificity (97.0%), and Positive Predictive Value (55.3%).(3)
Ontario HIV Database (HIV)	Canadian Institute for Health Information (CIHI)	The Ontario HIV Database contains all Ontario HIV positive patients identified since 1992. HIV positive patients are defined as persons having received at least 3 physician claims with OHIP diagnosis code 042, 043, or 044 within 3 years. The diagnosis date is the first of these claims, unless a prior OHIP record with the above diagnosis codes or a hospitalization having an ICD-10 diagnosis code of B20, B21, B22, B23, or B24 occurs earlier. This definition has been shown to have high sensitivity (96.2%) and specificity (99.6%)(4)

Supplement Table 4: Variable Definitions

Variable	Data Source	Definition Description
Age	RPDB	Age of the individual at the index date
Sex	RPDB	Sex of the individual
Rural status	RPDB	Resides in a rural area as defined as a settlement of <10 000 individuals
Location (city)	RPDB	City in which the individual is believed to reside as of July 1st of the index year, based on their census division information
Recent immigrant	IRCC	Presence of a landing date in the Immigration, Refugees and Citizenship Canada Permanent Database indicates immigration to Ontario between 1985 to 2018
Date of immigration	IRCC	Time, in years, since immigration to Ontario from outside Canada occurred
Refugee status	IRCC	Class of immigration status = Refugee
Congestive heart failure	CHF	Presence in the database indicates the individual has a history of congestive heart failure[1]
Chronic obstructive pulmonary disease	COPD	Presence in the database indicates the individual has a history of COPD[2]
Diabetes	ODD	Presence in the database indicates the individual has a history of diabetes[3]
HIV status	HIV	Presence in the database indicates the individual is HIV positive[4].
Chronic kidney disease	DAD, NACRS, OHIP	1 hospitalization or 3 ED visit or physician claims in 1 year within 3 years of the index date with any of the following eligible codes: ICD-10: E102, E112, E132, E142, I12, I13, N00, N01, N02, N03, N04, N05, N06, N07, N08, N1, N20, N21, N22, N23 OHIP dx: 403, 585
Chronic liver disease	DAD, NACRS, OHIP	1 hospitalization, ED visit or physician claim within 3 years of the index date with any of the following eligible codes: ICD-10: B16, B17, B18, B19, B942, E830, E831, I85, K70, K713, K714, K715, K717, K721, K729, K73, K74, K753, K754, K758, K759, K76, K77, R160, R162, R17, R18, Z225 OHIP dx: 070, 571, 573 OHIP fee: Z551, Z554
Psychosis related mental health care	DAD, NACRS, OMHRS, OHIP	1 hospitalization, ED visit or physician claim within 1 year of the index date with any of the following eligible codes: ICD-10: F20, F22, F23, F24, F25, F28, F29 DSM-IV: 295, 297, 298 OHIP dx: 295, 297, 298

Variable	Data Source	Definition Description
Non-psychotic disorders related mental health care	DAD, NACRS, OMHRS, OHIP	1 hospitalization, ED visit or physician claim within 1 year of the index date with any of the following eligible codes: ICD-10: F30, F31, F32, F33, F34, F38, F39, F40, F41, F42, F43, F48, F60, F93 DSM-IV: 296, 300, 301 OHIP dx: 296, 300, 301, 309, 311
Substance use related mental health care	DAD, NACRS, OMHRS, OHIP	1 hospitalization, ED visit or physician claim within 1 year of the index date with any of the following eligible codes: ICD-10: F10, F11, F12, F13, F14, F15, F16, F17, F18, F19, F55 DSM-IV: 291, 292, 303, 304, 305 OHIP dx: 291, 292, 303, 304, 305
Outpatient visits	OHIP	Number of physician visits within 1 year prior to the index date, defined as one visit per day per physician
Emergency department visits	NACRS	Number of ED visits within 1 year prior to the index date
Hospitalizations	DAD	Number of admissions to acute care hospitals within 1 year prior to the index date.

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(2) Hux JE, Ivis F, Flintoft V, Bica A. Diabetes in Ontario: determination of prevalence and incidence using a validated administrative data algorithm. Diabetes Care 2002; 25(3):512-516.

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(4) Tony Antoniou, Brandon Zagorski, Mona R. Loutfy, Carol Strike, Richard H. Glazier. Validation of Case-Finding Algorithms Derived from Administrative Data for Identifying Adults Living with Human Immunodeficiency Virus Infection. Plos One. 2011;6(6):e21748. Epub 2011 Jun 30.

Supplement Table 5 – Validation Statistic Formulae

The following diagnostic tests were used to assess the validity of each case ascertainment algorithm.

Validation Statistic	Formula
Sensitivity	TP / (TP + FN)
Specificity	TN / (FP + TN)
Positive Predictive Value	TP / (TP + FP)
Negative Predictive Value	TN / (FN + TN)
Positive Likelihood Ratio	Sensitivity / (1 - Specificity)

TP=True positive (truly experiencing homelessness and flagged as homeless by the case ascertainment algorithm)
FP=False positive (truly housed but flagged as homeless by the case ascertainment algorithm)
FN=False negative (truly experiencing homelessness but not flagged as homeless by the case ascertainment algorithm)
TN=True negative (truly housed and flagged as housed by the case ascertainment algorithm)

Supplement Table 6 – Additional Tables

Table 6A – Characteristics of true positives, false positives and false negatives using the optimal housing episode algorithm

	True Positives (N=613)	False Positives (N=595)	False Negatives (N=2,830)
Episodes without encounters, n (% of group)	0 (0%)	0 (0%)	1,825 (64.5%)
Cohort source = HHiT study, n (% of group)	613 (100%)	397 (66.7%)	2,830 (100%)

Optimal housing episode algorithm = 1 CIHI indicator +/-45 days of the housing episode start and end dates

Table 6B – Characteristics of true positives, false positives and false negatives using the (non-scalable) optimal annual housing experience algorithm

	True Positives (N=701)	False Positives (N=365)	False Negatives (N=1,589)
Episodes without encounters, n (% of group)	0 (0%)	0 (0%)	997 (62.7%)
Cohort source = HHiT study, n (% of group)	701 (100%)	115 (31.5%)	2,830 (100%)

Optimal annual housing experience algorithm = 1 CIHI indicator +/-15 days of the calendar year start and end dates or one postal code from PSTLYEAR

Table 6C – Number of adult Ontarians identified as experiencing homelessness by the optimal annual housing experience algorithm between 2007 and 2016

Year	# identified (95% CI)	Adult ON Population	Unadjusted Rate (95% CI)
2007	7,012 (6,850-7,178)	9,995,143	0.07% (0.069% - 0.072%)
2008	7,271 (7,106-7,440)	10,125,078	0.072% (0.07% - 0.073%)
2009	7,318 (7,152-7,488)	10,250,718	0.071% (0.07% - 0.073%)
2010	7,934 (7,761-8,110)	10,393,961	0.076% (0.075% - 0.078%)
2011	8,521 (8,342-8,704)	10,529,817	0.081% (0.079% - 0.083%)
2012	9,028 (8,844-9,216)	10,699,090	0.084% (0.083% - 0.086%)
2013	9,202 (9,016-9,392)	10,859,071	0.085% (0.083% - 0.086%)
2014	9,769 (9,577-9,965)	11,001,544	0.089% (0.087% - 0.091%)
2015	10,658 (10,458-10,862)	11,117,135	0.096% (0.094% - 0.098%)
2016	11,731 (11,521-11,945)	11,287,810	0.104% (0.102% - 0.106%)
Total individuals identified over 10 years			**54,873**
Individuals present in > 1 year estimate			**18,217 (33.2% of total)**

Adult ON Population derived from Ontario inter-censal population estimates.

Optimal annual housing experience algorithm = 1 CIHI indicator +/-15 days of the calendar year start and end dates.

Confidence intervals calculated using the Wilson score method.