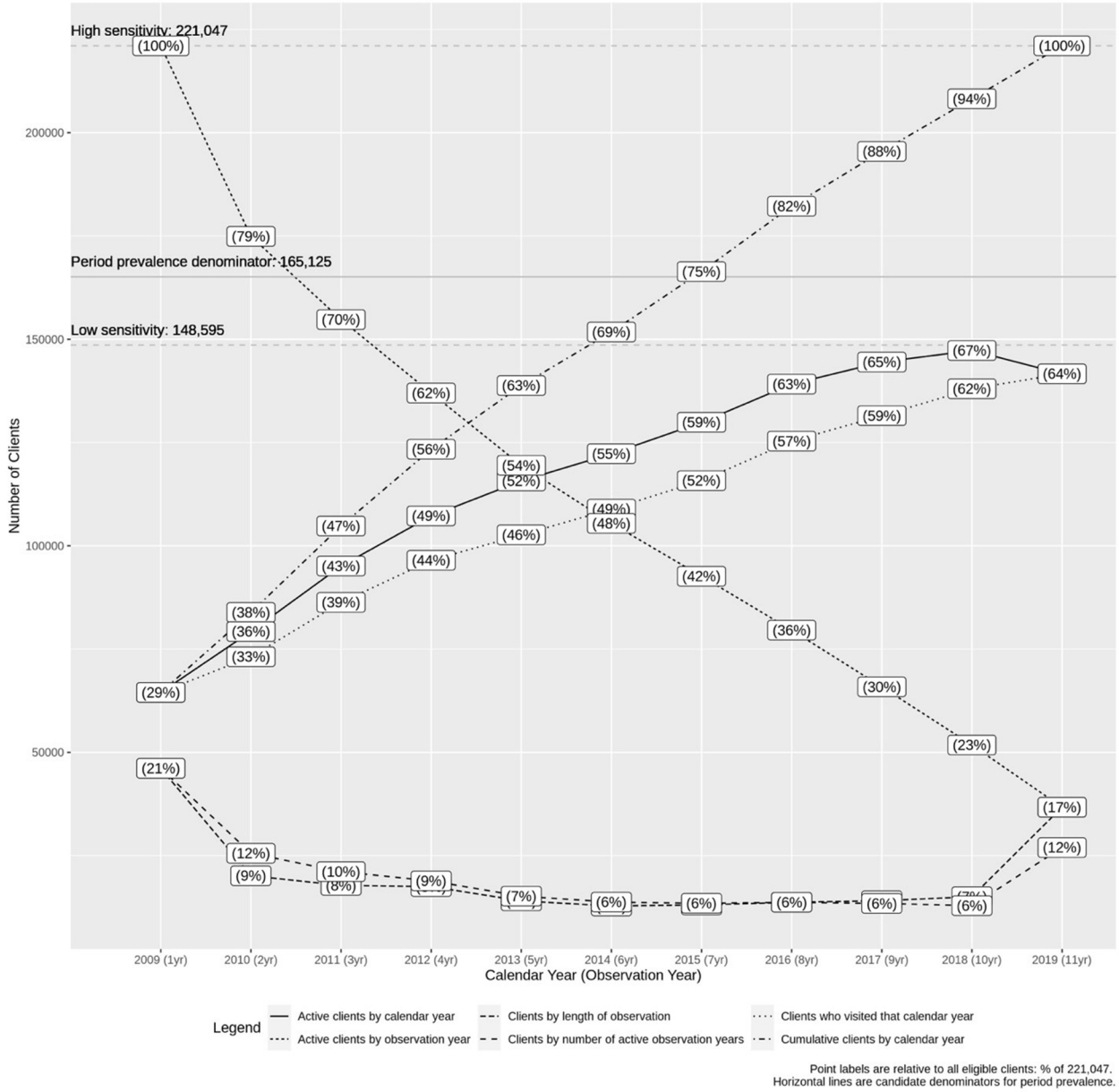
Supplementary material

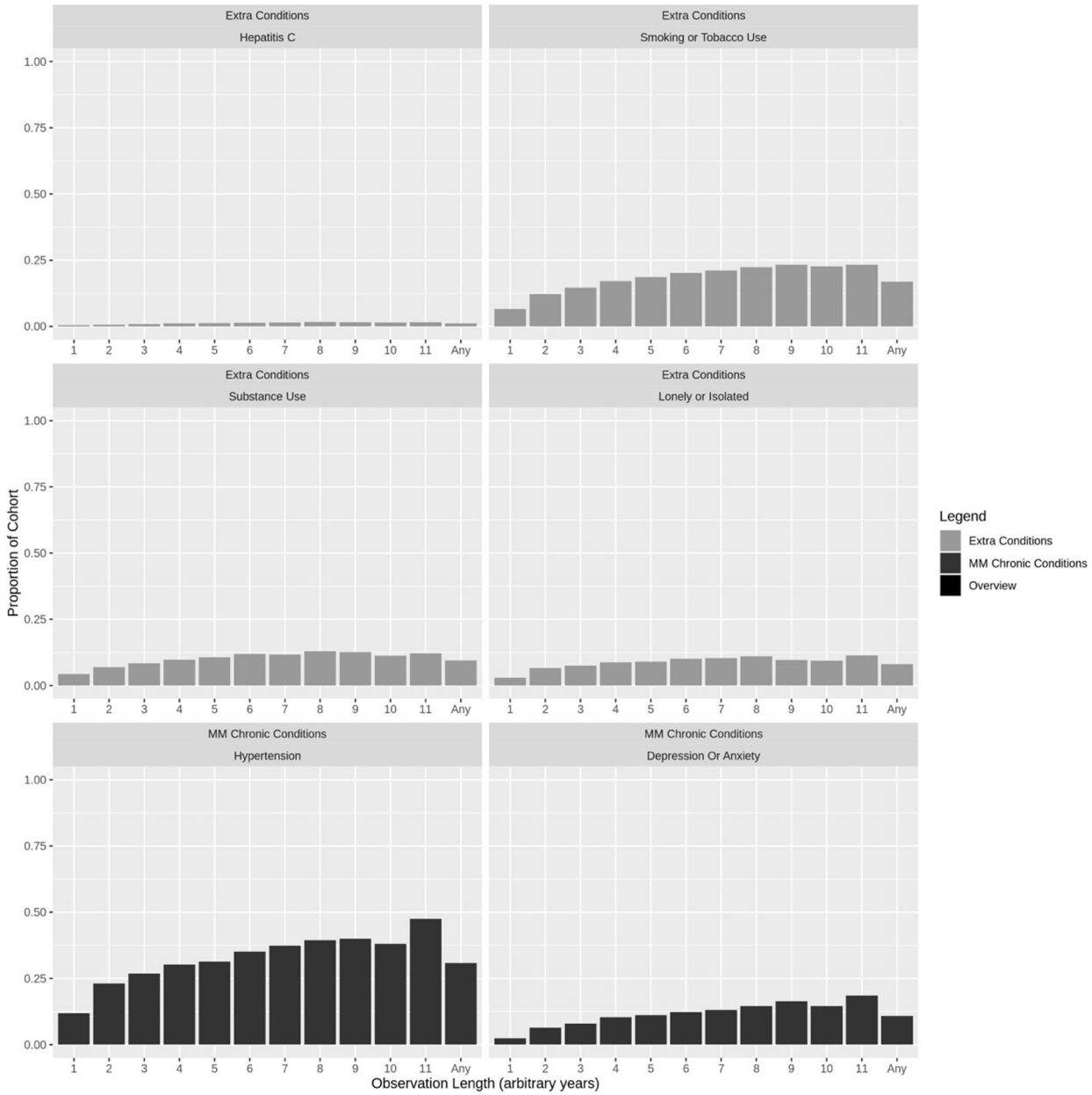
Appendix 1

Supplementary Figure 1: Cohort size by calendar- and observation-based time

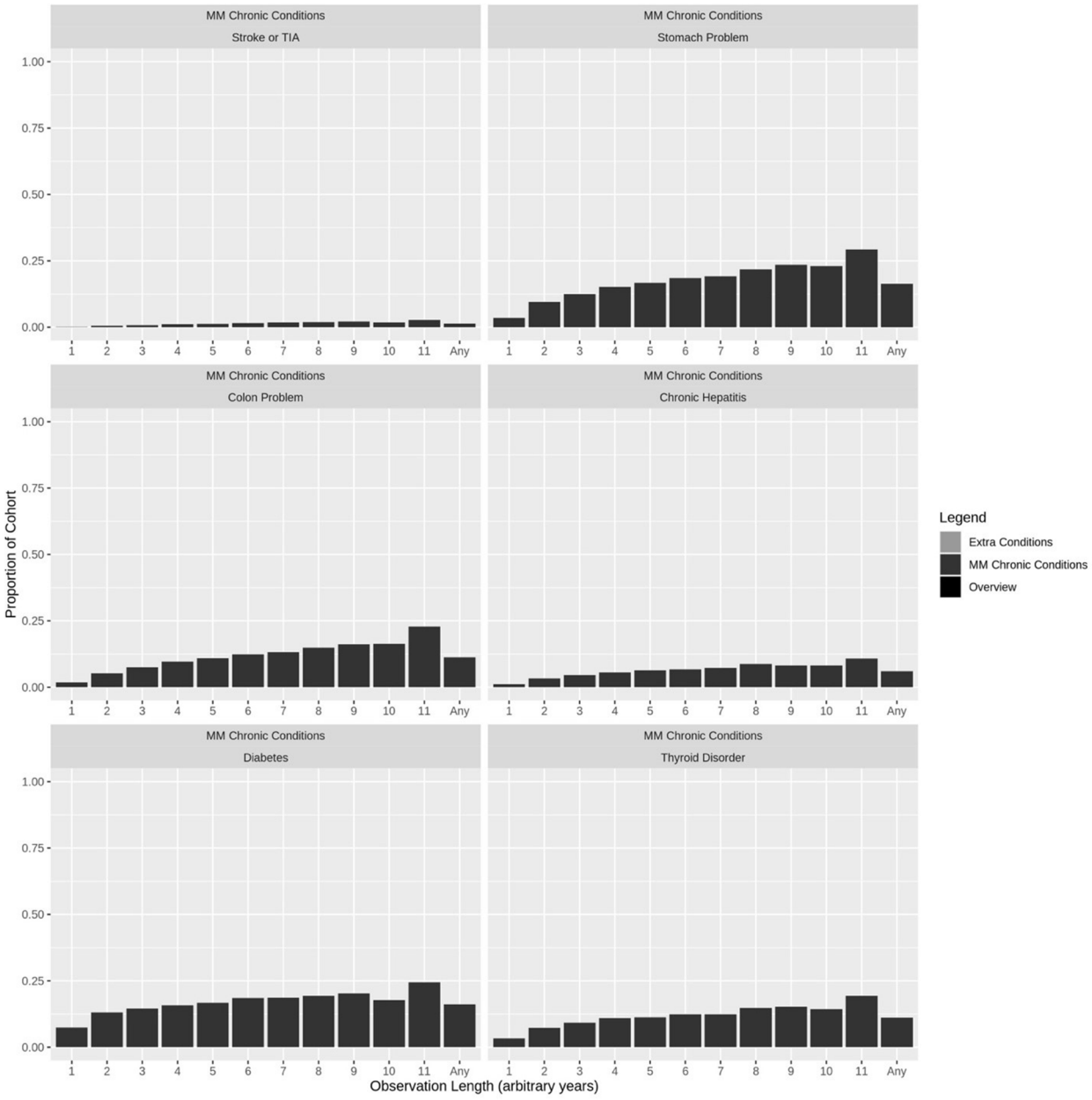


Active clients have at least one event during or after the year (calendar- or observation-based) of interest (gap years counted). The number of active observation years refers to the number of 365.25 day periods, counted from the first calendar date that an event was recorded for that client, that clients have at least one event recorded (gap years not counted). Length of observation refers to the number of years from the first to the last year that at least one event is recorded (gap years counted). Cumulative clients refers to the number of clients who have had at least one event during or before the year of interest.

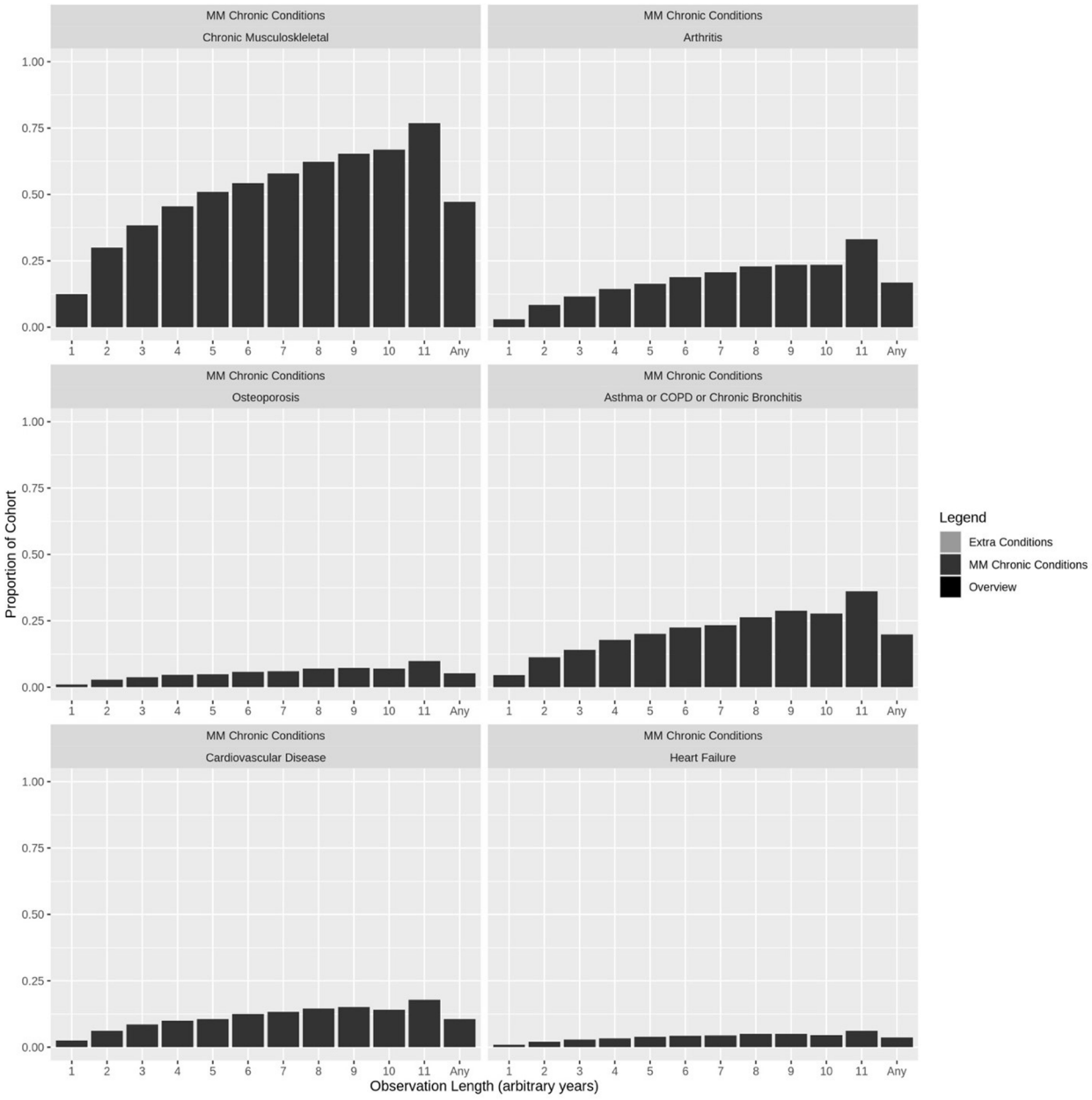
Supplementary Figure 2: Observation-based period prevalence



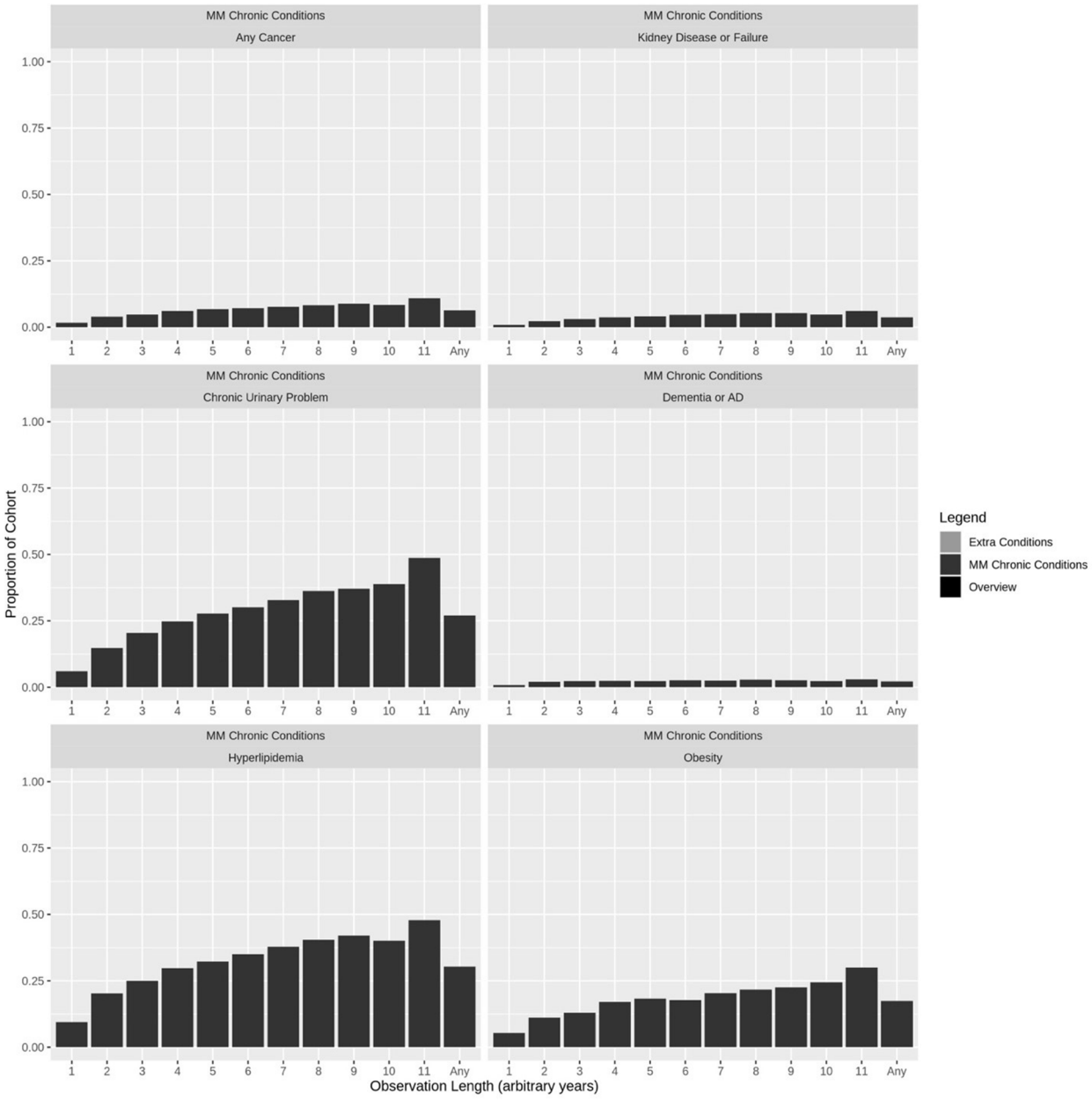
Supplementary Figure 2: Continued



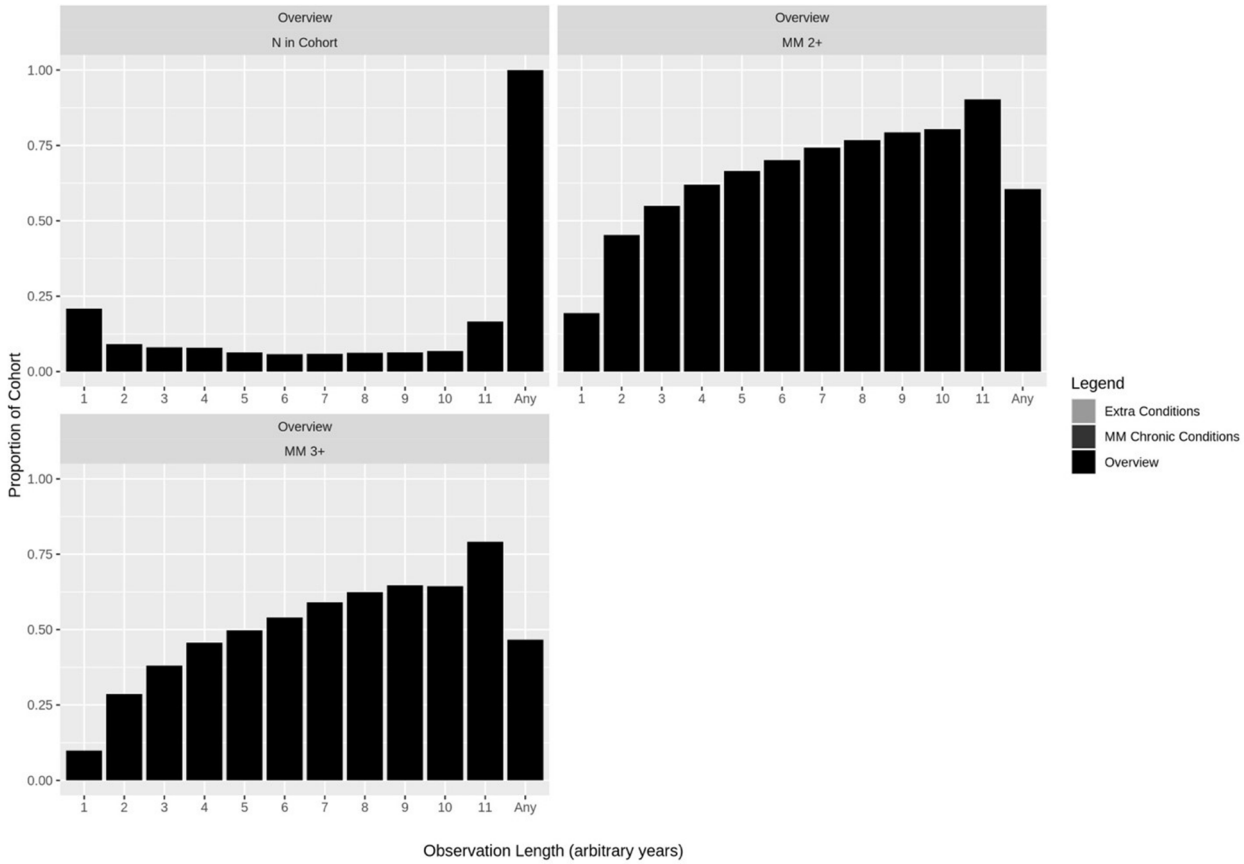
Supplementary Figure 2: Continued



Supplementary Figure 2: Continued

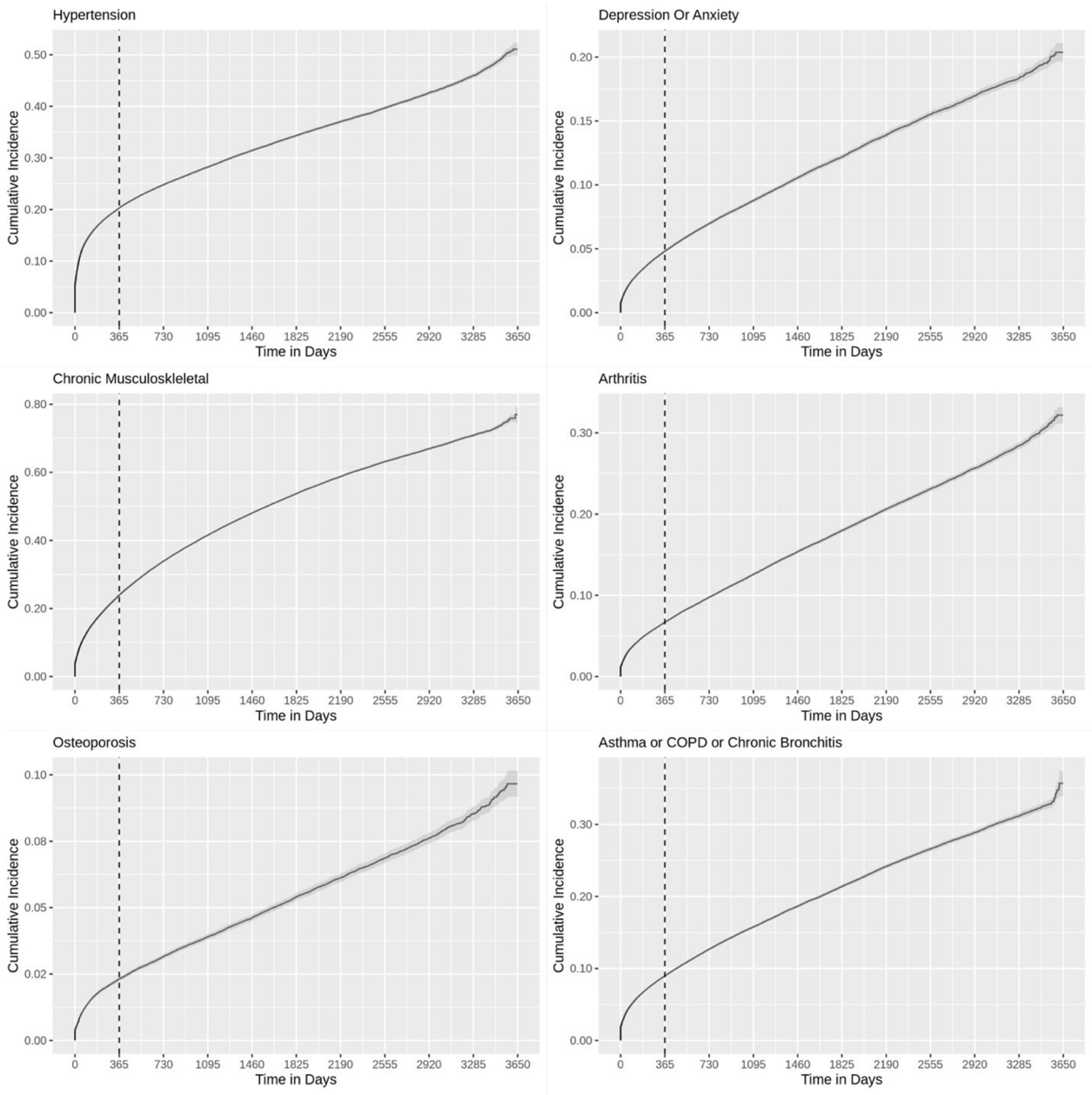


Supplementary Figure 2: Continued

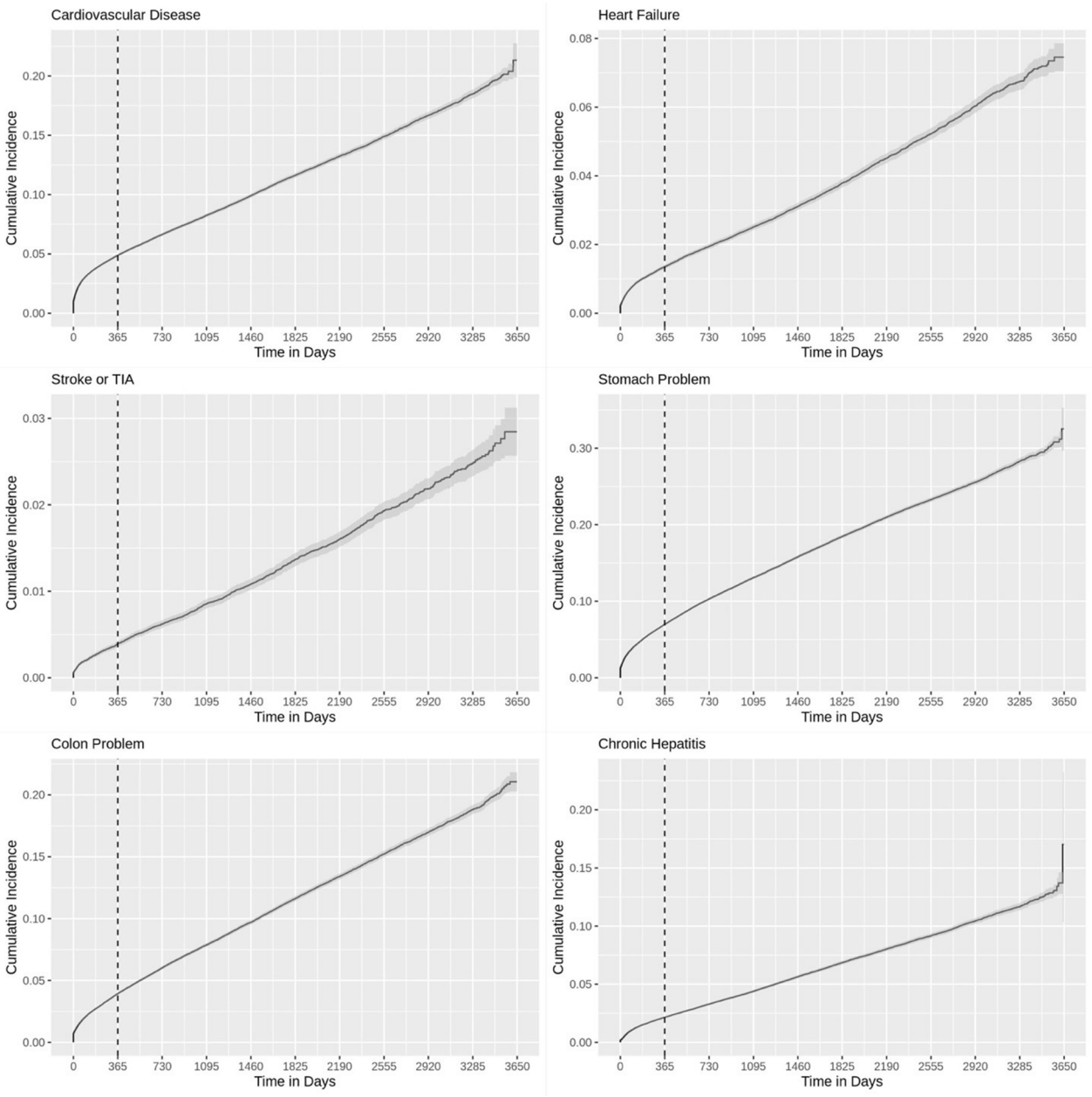


Each bar represents the proportion of clients within that observation-based cohort (years are arbitrary 365.25 day consecutive periods between the first and last recorded events) that have at least one indication of the condition of interest across their entire observation history. Conditions are grouped to represent 1) Extra conditions of interest to Alliance stakeholders, 2) 20 chronic conditions, which make up multimorbidity (MM) status, and 3) Overview indicators for the cohorts. *Legend:* COPD = Chronic Obstructive Pulmonary Disease; TIA = Transient Ischemic Attack; AD = Alzheimer's Disease.

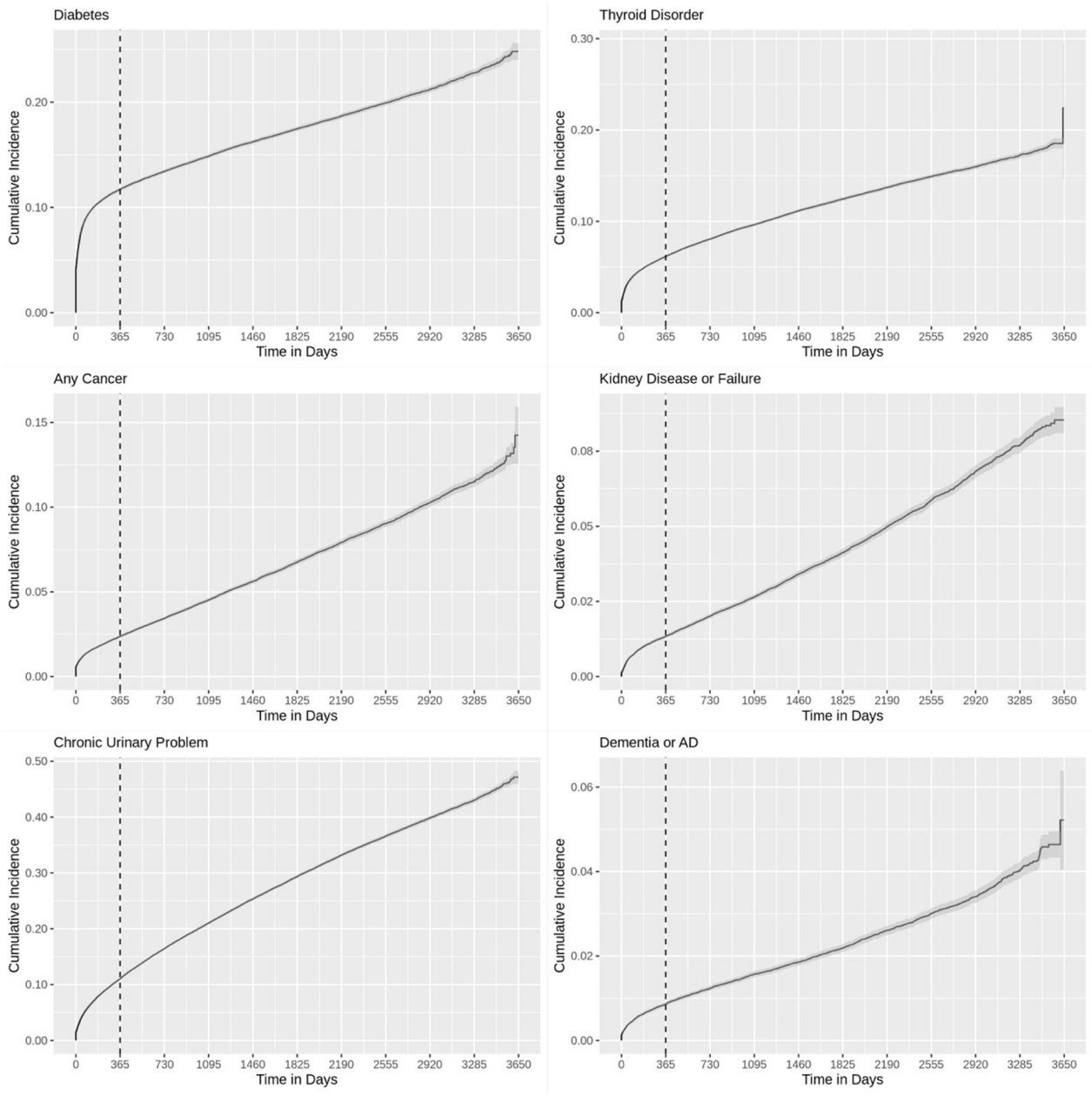
Supplementary Figure 3: Cumulative incidence



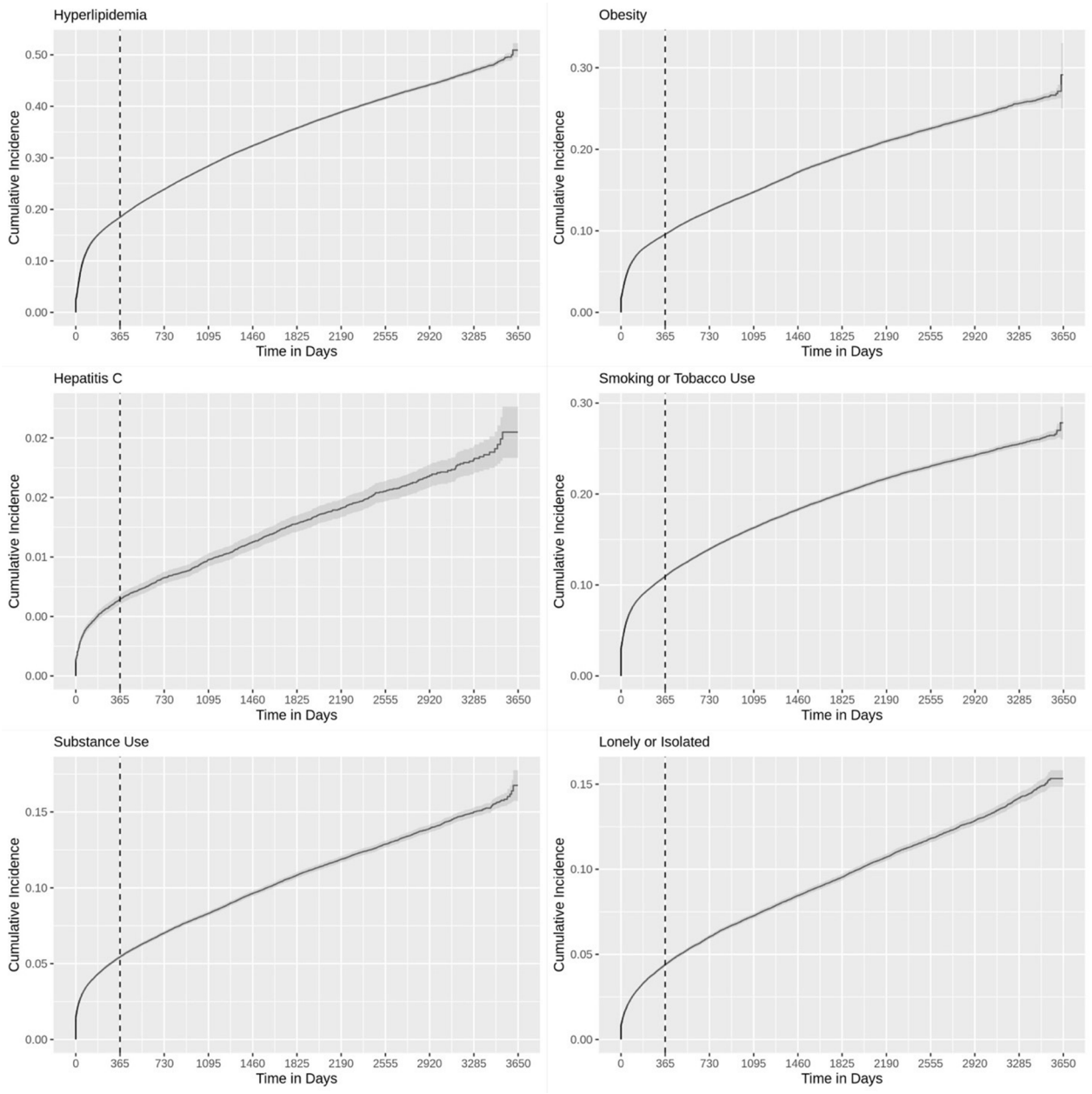
Supplementary Figure 3: Continued



Supplementary Figure 3: Continued



Supplementary Figure 3: Continued



Cumulative incidence plots by days of observation since the first recorded event. Clients eligible for this analysis must not have any care recorded in the first calendar-year of available data (2009).

Supplementary Appendix 2: 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	Abstract	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.	Abstract
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	Introduction		Introduction
Objectives	3	State specific objectives, including any prespecified hypotheses	Introduction		Introduction
Methods					
Study Design	4	Present key elements of study design early in the paper	Introduction, Methods – Study population and data source		Introduction, Methods – Study population and data source
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Methods – Study population and data source; additional details specific to analyses are presented under the appropriate sub-heading		Methods – Study population and data source; additional details specific to analyses are presented under the appropriate sub-heading
Participants	6	*(a) Cohort study* - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study* - 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 *Cross-sectional study* - Give the eligibility criteria, and the sources and methods of selection of participants *(b) Cohort study* - For matched studies, give matching criteria and number of exposed and unexposed *Case-control study* - For matched studies, give matching criteria and the number of controls per case	Methods	RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided. 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. 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.	Methods
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	Methods, Supplementary Table 1	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.	Supplementary Table 1
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	Methods, Supplementary Table 1		Methods, Supplementary Table 1

Continued

Supplementary Appendix 2: Continued

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Bias	9	Describe any efforts to address potential sources of bias	N/A		N/A
Study size	10	Explain how the study size was arrived at	Methods		Methods
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	Methods, Supplementary Table 1		Methods, Supplementary Table 1
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) *Cohort study* - If applicable, explain how loss to follow-up was addressed *Case-control study* - If applicable, explain how matching of cases and controls was addressed *Cross-sectional study* - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses	Methods		Methods
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. RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	Methods, Supplementary Table 1
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.	No linkage
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (*e.g.*, 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	Supplementary Appendix 3	RECORD 13.1: Describe in detail the selection of the persons included in the study (*i.e.*, 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.	Methods
Descriptive data	14	(a) Give characteristics of study participants (*e.g.*, 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) *Cohort study* - summarise follow-up time (*e.g.*, average and total amount)	Results, Supplementary Appendix 3		

Continued

Supplementary Appendix 2: Continued

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Outcome data	15	*Cohort study* - Report numbers of outcome events or summary measures over time *Case-control study* - Report numbers in each exposure category, or summary measures of exposure *Cross-sectional study* - Report numbers of outcome events or summary measures	Results, Supplementary Appendix 3		
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	Results, Supplementary Appendix 3		
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	Results, Supplementary Appendix 1,3		
Discussion					
Key results	18	Summarise key results with reference to study objectives	Discussion		Discussion
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	Discussion	RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	Discussion
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Discussion		Discussion
Generalisability	21	Discuss the generalisability (external validity) of the study results	N/A		N/A
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	Declarations		Declarations
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.	Given the sensitive nature of the data, this information is not shared.

Appendix 3

Eligible Clients: Of the 881,129 adult clients in the Alliance EHR database in 2009-2019, 232,529 (26.4%) have ongoing primary care client indications, and 221,047 (25.1%) have at least one encounter in 2009-2019 (fully eligible).

Supplementary Table 1: Characteristic variable definitions

Variable Name	Definition	Source used to guide variable operationalization, if any
Sociodemographic Characteristics		
Age in 2015	2015 minus Year of Birth	
Geography	Geography of place of residence based on Forward Sortation Area: Rural if second digit is 0; Urban if any other valid digit; NA otherwise.	(1)
Sex	Categories as recorded in client characteristic table	
Gender	Collapsed client characteristic table categories	(2)
Sexual Orientation	Categories as recorded in client characteristic table	
Highest Level of Education Completed	Collapsed client characteristic table categories	(2) followed to the extent possible
Primary Spoken Language	Collapsed client characteristic table categories into the two official languages of Canada with remaining languages categorized as Other.	
Race and Ethnicity	Collapsed client characteristic table categories	(3,4)
Year Since Arrival in Canada	Cleaned free text entries from client characteristic table and collapsed into 5 years, 6 or more years, and None Recorded categories. None Recorded cannot differentiate between never-immigrated and never-asked.	
Household Income	Collapsed client characteristic table categories	Note: could not reliably follow guidelines in (2)
Household Composition	Categories as recorded in client characteristic table	
Stable Residence	Collapsed client characteristic table categories into Stable or Unstable (homeless, shelter, other temporary). Additional unstable residence situations were identified as the presence of at least one ENCODE-FM code: 8990, 9433, 9434, 9435, 9436, 9437, 9438, 9439, 9440, 9441, 9442, 9443, 9432, 8982, 8986, 9419, 9424, 8985, 9431, 9415, 9425, 9412, 9414, which were given priority.	List of codes are from an Alliance for Healthier Communities stakeholder
Food Insecurity	At least one ENCODE-FM code: 8972, 9782, 9802, 8971, 9568, 9805	List of codes are from an Alliance for Healthier Communities stakeholder
Clinical Characteristics		
Hypertension	At least one ICD-10 code: i10,i11,i12,i13,i14,i15	(5)
Depression or Anxiety	At least one ICD-10 code: f33,f40,f41	(5)
Chronic Musculoskeletal Conditions causing pain or limitation	At least one ICD-10 code: m40,m41,m42,m43,m44,m45, m46,m47,m48,m49,m50,m51,m52,m53,m54,m60, m61,m62, m63,m65,m66,m67,m68,m70,m71,m72,m73, m74,m75,m76,m77,m78,m79	(5)
Arthritis and/or Rheumatoid Arthritis	At least one ICD-10 code: m05.9,m13.0,m13.9, m15,m16,m17,m18,m19	(5)
Osteoporosis	At least one ICD-10 code: m81	(5)
Asthma, Chronic Obstructive Pulmonary Disease, or Chronic Bronchitis	At least one ICD-10 code: j40,j41,j42,j43,j44,j45,j46	(5)
Cardiovascular Disease (angina, myocardial infarction, atrial fibrillation, poor circulation in the lower limbs)	At least one ICD-10 code: i20,i25,i48,i70,i71,i72,i73, i74,i75,i76,i77,i78,i79	(5)

Continued

Supplementary Table 1: Continued

Variable Name	Definition	Source used to guide variable operationalization, if any
Heart Failure (including valve problems or replacement)	At least one ICD-10 code: i05,i06,i07,i08,i09,i34,i35, i36,i37,i38,i39,i42,i43,i50	(5)
Stroke and Transient Ischemic Attack	At least one ICD-10 code: g45,i62	(5)
Stomach Problem (irritable bowel, Chron's disease, ulcerative colitis, diverticulosis)	At least one ICD-10 code: k21,k25.7,k29.5	(5)
Colon Problem	At least one ICD-10 code: k50,k51,k52,k57,k58	(5)
Chronic Hepatitis	At least one ICD-10 code: k70,k71,k72,k73,k74, k75,k76,k77	(5)
Diabetes	At least one ICD-10 code: e10,e11,e12,e13,e14	(5)
Thyroid Disorder	At least one ICD-10 code: e00,e01,e02,e03,e04,e05, e06,e07	(5)
Any Cancer (including melanoma, but excluding other skin cancers)	At least one ICD-10 code: c00,c01,c02,c03,c04, c05,c06,c07,c08,c09,c10,c11,c12,c13,c14,c15,c16,c17,c18, c19,c20,c21,c22,c23,c24,c25,c26,c27,c28,c29,c30,c31,c32, c33,c34,c35,c36,c37,c38,c39,c40,c41,c42,c43,c44,c45,c46, c47,c48,c49,c50,c51,c52,c53,c54,c55,c56,c57,c58,c59,c60, c61,c62,c63,c64,c65,c66,c67,c68,c69,c70,c71,c72,c73,c74, c75,c76,c77,c78,c79,c80,c81,c82,c83,c84,c85,c86,c87,c88, c89,c90,c91,c92,c93,c94,c95,c96,c97	(5) modified by removing the 5 year restriction; taking any cancer indication within the 10 year period
Kidney Disease or Failure	At least one ICD-10 code: n18,n19	(5)
Chronic Urinary Problem	At least one ICD-10 code: n03,n11,n18,n20,n21,n22,n23,n25,n26,27,n28,n29, n30,n31,n32,n33,n34,n35,n36,n37,n38,n39,n40,n41, n42,n43,n44,n45,n46,n47,n48,n49,n50,n51+B38	(5)
Dementia or Alzheimer's Disease	At least one ICD-10 code: f00,f01,f02,f03	(5)
Hyperlipidemia (high cholesterol)	At least one ICD-10 code: e78	(5)
Obesity	At least one ICD-10 code: e66	(5) ICD-10 only; no BMI
Hepatitis C	At least one ICD-10 code: b18.2,b19.20,b19.21	(6)
Smoking or Tobacco Use	At least one ENCODE-FM code: 10072,5520, 679,9910,5339,5340,5341,5342,5343,5344,5345,5346, 5347,5348,5349	JKK selected relevant ENCODE-FM codes based on manual review
Substance Use	At least one ENCODE-FM code: 5304,10004,10005,5305,5306,5307,9754,5308,5309, 5310,5311,5312,5313,5314,5315,5316,5317,5318,5319, 5320,5321,5322,5323,5324,5325,5326,5327,5328,5329, 5330,5331,5332,5333,5334,5335,5336,5337,5338,5350, 5351,5352,5353,5354,5355,5356,5357,5358,5359,5360, 5361,5362,5363,5364,5365,5366,5367,5368,5369,5370, 5371,10007,5372,5373,5374,5375,5376,5377,5378,5379, 5380,5381,5382,5383,5384,5385,5386,5387,5388,5389, 5390,5391,5392,5393,5394,5395,5396,5397,5398,5399, 5400,9845,5401,9844,5401,5402,5403,5404,5405,5406, 5407,5408,5409,5410,5411,5412,5413,5414,5415,5416, 5417,5418,5419,5420,5421,5422,5423,5424,5425,5426, 5427,5428,5429,5430,5431,5432,5433,5434,5435,5436, 5437,5438,5439,5440,5441,5442,5443,5444,5445,5446, 5447,5448,5449,9277,9278,5450,5451,5452,5453,5454, 5455,5456,5457,5458,5459,5460,5461,5462,5463,5464, 5465,5466,5467,5468,5469,5470,5471,5472,5473,5474, 5475,5476,5477,5478,5479,5480,5481 or recorded in Disabilities Table	JKK selected relevant ENCODE-FM codes based on manual review

Continued

Supplementary Table 1: Continued

Variable Name	Definition	Source used to guide variable operationalization, if any
Lonely or Isolated	At least one ENCODE-FM code: 5138, 5139, 9265, 9267, 9268, 9512	List of codes are from an Alliance for Healthier Communities stakeholder
Health Care Use Characteristics		
# Years of Observation	Based on records in the service event table: Ceiling of number of days from first to last recorded event divided by 365.25	
# Provider Types Seen	Number of unique provider types recorded in providers involved table. Provider types were maintained as entered except Other, Unknown, and Undefined were collapsed	
# Internal Referrals	Number of records in the internal referrals table	
# External Referrals	Number of records in the external referrals table	
Avg. # Days per Year	Based on records in the service event table: Sum of unique calendar days with at least one event recorded divided by Number of Years of Observation	
Max # Days per Year	Based on records in the service event table: Maximum of number of unique calendar days care is accessed in a single calendar year	
Avg. # Events per Day	Based on records in the service event table: Sum of events divided by number of calendar days care is accessed at least once	
Max # Events per Day	Based on records in the service event table: Maximum number of events recorded in a single calendar day	

Legend: # = Number; Avg. = Average; CHC = Community Health Centre; ENCODE-FM = Electronic Nomenclature and Classification Of Disorders and Encounters for Family Medicine; ICD = International Classification of Disease; SD = Standard Deviation; UAR = Urban at Risk.

References:

(1) Canada Post. Addressing guidelines - Forward Sortation Area (FSA) [Internet]. Canada Post. 2022 [cited 2022 Feb 8]. Available from: https://www.canadapost-postescanada.ca/cpc/en/support/articles/addressing-guidelines/postal-codes.page.

(2) CIHI. In Pursuit of Health Equity: Defining Stratifiers for Measuring Health Inequality - A Focus on Age, Sex, Gender, Income, Education and Geographic Location. Ottawa, ON: Canadian Institute for Health Information; 2018 Apr. Available from: https://www.cihi.ca/sites/default/files/document/defining-stratifiers-measuring-health-inequalities-2018-en-web.pdf.

(3) CIHI. Proposed Standards for Race-Based and Indigenous Identity Data Collection and Health Reporting in Canada. Ottawa, ON: Canadian Institute for Health Information; 2020. Available from: https://www.cihi.ca/en/proposed-standards-for-race-based-and-indigenous-identity-data.

(4) Flanagin A, Frey T, Christiansen SL, AMA Manual of Style Committee. Updated guidance on the reporting of race and ethnicity in medical and science journals. JAMA. 2021 Aug 17;326(7):621–7.

(5) Fortin M, Almirall J, Nicholson K. Development of a research tool to document self-reported chronic conditions in primary care. J Comorb. 2017 Jan 1;7(1):117–23.

(6) Support Path. Hepatitis C ICD-10 Codes. Gilead Sciences; 2015 [cited 2020 Sep 25]. Available from: https://www.cvph.org/data/files/mysupportpath.pdf.

Supplementary Table 2: Sociodemographic characteristics with sub-strata

Characteristic	Values	All clients n (%)	UAR & MM n (%)	UAR & Non-MM n (%)	Non-UAR & MM n (%)	Non-UAR & Non-MM n (%)
Number of clients		221047	19237	16761	83935	101114
Age in 2015	25-34	55505 (25.11)	1864 (9.69)	6112 (36.47)	7482 (8.91)	40047 (39.61)
	35-44	45646 (20.65)	3154 (16.40)	4386 (26.17)	12388 (14.76)	25718 (25.43)
	45-54	44653 (20.20)	4784 (24.87)	3402 (20.30)	19198 (22.87)	17269 (17.08)
	55-64	37848 (17.12)	4935 (25.65)	1855 (11.07)	20643 (24.59)	10415 (10.30)
	65-74	23162 (10.48)	2952 (15.35)	692 (4.13)	14828 (17.67)	4690 (4.64)
	75+	14233 (6.44)	1548 (8.05)	314 (1.87)	9396 (11.19)	2975 (2.94)
Geography	Rural	49275 (22.29)	3479 (18.08)	2652 (15.82)	23339 (27.81)	19805 (19.59)
	Urban	167728 (75.88)	15291 (79.49)	13247 (79.03)	59720 (71.15)	79470 (78.59)
	Missing	4044 (1.83)	467 (2.43)	862 (5.14)	876 (1.04)	1839 (1.82)
Sex	Female	127070 (57.49)	10647 (55.35)	8052 (48.04)	49299 (58.73)	59072 (58.42)
	Male	93294 (42.21)	8561 (44.50)	8590 (51.25)	34563 (41.18)	41580 (41.12)
	Other	331 (0.15)	3 (0.02)	40 (0.24)	16 (0.02)	272 (0.27)
	Missing	352 (0.16)	26 (0.14)	79 (0.47)	57 (0.07)	190 (0.19)
Gender	Female	41352 (18.71)	3352 (17.42)	2157 (12.87)	18479 (22.02)	17364 (17.17)
	Gender diverse	340 (0.15)	52 (0.27)	60 (0.36)	92 (0.11)	136 (0.13)
	Male	29366 (13.28)	2425 (12.61)	2160 (12.89)	12308 (14.66)	12473 (12.34)
	Prefer not to answer	1001 (0.45)	37 (0.19)	14 (0.08)	339 (0.40)	611 (0.60)
	Missing	148988 (67.40)	13371 (69.51)	12370 (73.80)	52717 (62.81)	70530 (69.75)
Sexual Orientation	Bisexual	1578 (0.71)	141 (0.73)	144 (0.86)	549 (0.65)	744 (0.74)
	Gay	708 (0.32)	94 (0.49)	98 (0.58)	212 (0.25)	304 (0.30)
	Heterosexual	57065 (25.82)	4703 (24.45)	3744 (22.34)	24402 (29.07)	24216 (23.95)
	Lesbian	485 (0.22)	45 (0.23)	25 (0.15)	199 (0.24)	216 (0.21)
	Queer	323 (0.15)	14 (0.07)	20 (0.12)	77 (0.09)	212 (0.21)
	Two-Spirit	128 (0.06)	40 (0.21)	40 (0.24)	21 (0.03)	27 (0.03)
	Other	246 (0.11)	21 (0.11)	13 (0.08)	122 (0.15)	90 (0.09)
	Do not know	924 (0.42)	113 (0.59)	88 (0.53)	372 (0.44)	351 (0.35)
	Prefer not to answer	7561 (3.42)	565 (2.94)	312 (1.86)	3513 (4.19)	3171 (3.14)
	Missing	152029 (68.78)	13501 (70.18)	12277 (73.25)	54468 (64.89)	71783 (70.99)
Highest Level of Education	Post-secondary or equivalent	84888 (38.40)	6463 (33.60)	5593 (33.37)	29300 (34.91)	43532 (43.05)
	Secondary or equivalent	61831 (27.97)	6656 (34.60)	5127 (30.59)	25961 (30.93)	24087 (23.82)
	Less than high school	18941 (8.57)	1886 (9.80)	1380 (8.23)	8732 (10.40)	6943 (6.87)
	Other	8507 (3.85)	384 (2.00)	335 (2.00)	3694 (4.40)	4094 (4.05)
	Do not know	4860 (2.20)	734 (3.82)	584 (3.48)	1616 (1.93)	1926 (1.90)
	Prefer not to answer	2950 (1.33)	273 (1.42)	149 (0.89)	1312 (1.56)	1216 (1.20)
	Missing	39070 (17.67)	2841 (14.77)	3593 (21.44)	13320 (15.87)	19316 (19.10)
Primary Language	English	167163 (75.62)	17036 (88.56)	14622 (87.24)	62563 (74.54)	72942 (72.14)
	French	22547 (10.20)	554 (2.88)	390 (2.33)	10537 (12.55)	11066 (10.94)
	Other	26847 (12.15)	1473 (7.66)	1475 (8.80)	9237 (11.00)	14662 (14.50)
	Missing	4490 (2.03)	174 (0.90)	274 (1.63)	1598 (1.90)	2444 (2.42)
Race and Ethnicity	Black	8861 (4.01)	337 (1.75)	388 (2.31)	3420 (4.07)	4716 (4.66)
	East/SouthEast Asian	3739 (1.69)	248 (1.29)	236 (1.41)	1297 (1.55)	1958 (1.94)
	Indigenous	2944 (1.33)	838 (4.36)	739 (4.41)	803 (0.96)	564 (0.56)
	Latino	4350 (1.97)	102 (0.53)	104 (0.62)	1606 (1.91)	2538 (2.51)
	Middle Eastern	2046 (0.93)	149 (0.77)	195 (1.16)	689 (0.82)	1013 (1.00)
	Other	567 (0.26)	79 (0.41)	69 (0.41)	227 (0.27)	192 (0.19)
	South Asian	3597 (1.63)	232 (1.21)	91 (0.54)	1620 (1.93)	1654 (1.64)
	White	38464 (17.40)	2661 (13.83)	1870 (11.16)	18843 (22.45)	15090 (14.92)
	Do not know	838 (0.38)	91 (0.47)	60 (0.36)	396 (0.47)	291 (0.29)
	Prefer not to answer	2649 (1.20)	165 (0.86)	96 (0.57)	1348 (1.61)	1040 (1.03)
	Missing	152992 (69.21)	14335 (74.52)	12913 (77.04)	53686 (63.96)	72058 (71.26)
Years Since Arrival in Canada	0 to 5 years	13 654 (6.18)	315 (1.64)	876 (5.23)	2732 (3.25)	9731 (9.62)
	6+ years	51815 (23.44)	2863 (14.88)	2077 (12.39)	19859 (23.66)	27016 (26.72)
	None recorded	155578 (70.38)	16059 (83.48)	13808 (82.38)	61344 (73.09)	64367 (63.66)

Continued

Supplementary Table 2: Continued

Characteristic	Values	All clients n (%)	UAR & MM n (%)	UAR & Non-MM n (%)	Non-UAR & MM n (%)	Non-UAR & Non-MM n (%)
Household Income	$0 to $14,999	40519 (18.33)	4476 (23.27)	4253 (25.37)	13281 (15.82)	18509 (18.31)
	$15,000 to $24,999	21102 (9.55)	2095 (10.89)	1460 (8.71)	8986 (10.71)	8561 (8.47)
	$25,000 to $39,999	20877 (9.44)	1772 (9.21)	1216 (7.25)	8964 (10.68)	8925 (8.83)
	$40,000 to $59,999	17245 (7.80)	1455 (7.56)	966 (5.76)	7216 (8.60)	7608 (7.52)
	$60,000 or more	28494 (12.89)	2092 (10.87)	1770 (10.56)	10776 (12.84)	13856 (13.7)
	Do not know	15408 (6.97)	1301 (6.76)	1357 (8.10)	4963 (5.91)	7787 (7.70)
	Prefer not to answer	27621 (12.50)	2437 (12.67)	1693 (10.10)	12453 (14.84)	11038 (10.92)
	Missing	49781 (22.52)	3609 (18.76)	4046 (24.14)	17296 (20.61)	24830 (24.56)
Household Composition	Couple with children	53398 (24.16)	3280 (17.05)	3479 (20.76)	17433 (20.77)	29206 (28.88)
	Couple without child	39664 (17.94)	3907 (20.31)	2038 (12.16)	19043 (22.69)	14676 (14.51)
	Extended family	7632 (3.45)	578 (3.00)	545 (3.25)	3003 (3.58)	3506 (3.47)
	Grandparents with grandchild(ren)	1746 (0.79)	187 (0.97)	60 (0.36)	996 (1.19)	503 (0.50)
	Siblings	1622 (0.73)	140 (0.73)	110 (0.66)	529 (0.63)	843 (0.83)
	Single parent	14445 (6.53)	1344 (6.99)	1183 (7.06)	5004 (5.96)	6914 (6.84)
	Sole member	32782 (14.83)	4503 (23.41)	2942 (17.55)	14094 (16.79)	11243 (11.12)
	Unrelated housemates	8622 (3.90)	669 (3.48)	898 (5.36)	2180 (2.60)	4875 (4.82)
	Other	8913 (4.03)	788 (4.10)	688 (4.10)	3414 (4.07)	4023 (3.98)
	Do not know	2475 (1.12)	301 (1.56)	342 (2.04)	978 (1.17)	854 (0.84)
	Prefer not to answer	3727 (1.69)	262 (1.36)	229 (1.37)	1665 (1.98)	1571 (1.55)
	Missing	46021 (20.82)	3278 (17.04)	4247 (25.34)	15596 (18.58)	22900 (22.65)
Stable Residence	True	199349 (90.18)	14813 (77.00)	13414 (80.03)	75666 (90.15)	95456 (94.40)
Food Insecurity	True	10985 (4.97)	2066 (10.74)	881 (5.26)	5257 (6.26)	2781 (2.75)

Legend: CHC = Community Health Centre; MM = Multimorbidity; UAR = Urban at Risk.

Supplementary Table 3: Health care use characteristics

Measure	Value	All clients	UAR CHC	Rural CHC	Multimorbidity
# Years of Observation	Min, Median, Max	(1, 5, 11)	(1, 6, 11)	(1, 7, 11)	(1, 8, 11)
	Mean (SD)	5.6 (3.7)	6.1 (3.8)	6.7 (3.6)	7.4 (3.3)
11 Years of Observation	n (%)	36 724 (16.6)	7976 (22.2)	5374 (25)	29 062 (28.2)
# Provider Types Seen	Min, Median, Max	(0, 4, 19)	(0, 5, 19)	(0, 5, 14)	(0, 6, 19)
	Mean (SD)	4.5 (2.3)	5.1 (2.6)	4.8 (2.1)	5.8 (2.2)
# Internal Referrals	Min, Median, Max	(0, 0, 300)	(0, 1, 300)	(0, 0, 51)	(0, 1, 300)
	Mean (SD)	1.7 (4.3)	2.8 (7.0)	1.4 (2.8)	2.8 (5.7)
# External Referrals	Min, Median, Max	(0, 1, 309)	(0, 2, 309)	(0, 1, 46)	(0, 3, 309)
	Mean (SD)	2.9 (4.5)	3.8 (5.9)	2.5 (3.2)	4.8 (5.5)
Avg. # Days/Year	Min, Median, Max	(0.2, 6, 176.9)	(0.2, 6.9, 129.7)	(0.2, 6.2, 120.3)	(0.3, 9.2, 176.9)
	Mean (SD)	8 (7.4)	9.4 (8.9)	8 (6.7)	11.4 (8.4)
Max # Days/Year	Min, Median, Max	(1, 10, 349)	(1, 12, 245)	(1, 11, 349)	(1, 17, 349)
	Mean (SD)	13.7 (13)	16.8 (16.6)	14.2 (12.1)	20.3 (14.4)
Avg. # Events/Day	Min, Median, Max	(1, 1.2, 66)	(1, 1.2, 29)	(1, 1.2, 31)	(1, 1.2, 31)
	Mean (SD)	1.3 (0.5)	1.3 (0.3)	1.3 (0.3)	1.3 (0.3)
Max # Events/Day	Min, Median, Max	(1, 3, 635)	(1, 3, 635)	(1, 3, 224)	(1, 3, 635)
	Mean (SD)	3.9 (7.8)	4.1 (8.2)	3.8 (6.1)	5.5 (10.7)

Legend: # = Number; Avg. = Average; CHC = Community Health Centre; SD = Standard Deviation; UAR = Urban at Risk.

Supplementary Table 4: Provider type counts

Type	Provider type	Number of events	% of events
Provider Involved in Care	Physician	3693760	30.1
	Nurse Practitioner (RN-EC)	2608238	21.3
	Nurse	2475621	20.2
	Registered Practical Nurse (RPN)	990144	8.1
	Social worker	452641	3.7
	Other/Unknown/Undefined	448761	3.7
	Dietitian/Nutritionist	268395	2.2
	Chiropodist	259101	2.1
	Counselor	212799	1.7
	Physiotherapist	171291	1.4
Internal Referral	Other/Unknown/Undefined	100649	26.7
	Physician	73070	19.4
	Nurse Practitioner (RN-EC)	37333	9.9
	Dietitian/Nutritionist	30670	8.1
	Nurse	29326	7.8
	Social worker	28357	7.5
	Physiotherapist	11210	3.0
	Chiropractor	9881	2.6
	Chiropodist	9741	2.6
	Counselor	6068	1.6
External Referral	Other/Unknown/Undefined	183804	28.5
	Dermatologist	41388	6.4
	Surgeon - general	40736	6.3
	Gastroenterologist	33737	5.2
	Surgeon - specialty (eye, heart, brain, etc.)	29370	4.6
	Physiotherapist	27639	4.3
	Ear Nose Throat (E.N.T.) specialist	25791	4.0
	Urologist	22546	3.5
	Gynecologist	21701	3.4
	Cardiologist	20592	3.2

Supplementary Table 5: Time series clustering of care access frequency

Analysis	# Clusters (Silhouette Score)	Cluster ID	# Clients	% Clients	Medoid
Short Term by Year	K = 2 (SS = 0.502)	1	11 552	30.5	20, 8
		2	26 368	69.5	6, 2
	K = 3 (SS = 0.301)	1	15 067	39.7	12, 3
		2	16 791	44.3	4, 1
		3	6062	16.0	24, 9
	K = 4 (SS = 0.142)	1	12 931	34.1	5, 1
		2	13 063	34.4	12, 3
		3	5602	14.8	1, 2
		4	6324	16.7	25, 8
	K = 5 (SS = 0.211)	1	3639	9.6	31, 8
		2	11 533	30.4	8, 1
		3	11 155	29.4	3, 2
		4	7722	20.4	12, 5
		5	3871	10.2	17, 11
Short Term by Quarter	K = 2 (SS = 0.541)	1	6068	16.0	10, 5, 5, 7, 3
		2	31 852	84.0	3, 1, 0, 1, 2
	K = 3 (SS = 0.249)	1	10 780	28.4	6, 3, 1, 2, 1
		2	20 431	53.9	2, 0, 0, 0, 1
		3	6709	17.7	6, 1, 3, 4, 3
	K = 4 (SS = 0.044)	1	14 389	37.9	3, 0, 1, 1, 1
		2	8939	23.6	6, 1, 0, 1, 2
		3	9072	23.9	2, 1, 0, 1, 2
		4	5520	14.6	9, 4, 2, 5, 3
	K = 5 (SS = 0.121)	1	4163	11.0	11, 8, 4, 5, 2
		2	7084	18.7	3, 1, 0, 4, 1
		3	17 282	45.6	3, 1, 0, 1, 2
		4	6111	16.1	5, 2, 1, 0, 1
		5	3280	8.6	6, 0, 1, 6, 1
Long Term by Year	K = 2 (SS = 0.553)	1	34 265	80.0	8, 3, 3, 2, 0, 1, 2, 6
		2	8590	20.0	15, 24, 20, 19, 20, 27, 23, 11
	K = 3 (SS = 0.149)	1	15 831	36.9	9, 4, 8, 3, 3, 2, 5, 2
		2	10 557	24.6	24, 9, 13, 19, 12, 12, 16, 6
		3	16 467	38.4	4, 0, 0, 1, 0, 0, 1, 4
	K = 4 (SS = 0.155)	1	2402	5.6	18, 35, 34, 46, 34, 39, 27, 9
		2	23 637	55.2	8, 3, 2, 2, 4, 1, 2, 3
		3	8440	19.7	5, 0, 0, 0, 0, 1, 13, 3
		4	8376	19.5	20, 8, 10, 12, 16, 11, 19, 9
	K = 5 (SS = 0.136)	1	6206	14.5	17, 7, 1, 1, 2, 2, 4, 2
		2	5166	12.1	9, 13, 11, 11, 15, 21, 22, 9
		3	4716	11.0	27, 16, 11, 7, 10, 10, 13, 5
		4	11 254	26.3	6, 2, 6, 6, 7, 7, 12, 3
		5	15 513	36.2	3, 0, 0, 0, 0, 1, 5, 2
Long Term by Quarter	K = 2 (SS = 0.536)	1	36 775	85.8	4, 1, 0, 2, 0, 0, 0, 0, 0, 1, 4, 0, 0, 0, 0, 1, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 2
		2	6080	14.2	7, 1, 6, 2, 3, 10, 6, 4, 5, 6, 5, 5, 2, 4, 4, 7, 6, 4, 5, 3, 5, 4, 7, 6, 9, 11, 6, 8, 3, 4
	K = 3 (SS = 0.007)	1	16 528	38.6	1, 0, 5, 0, 1, 2, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 2, 1, 0, 1
		2	9729	22.7	5, 3, 1, 1, 1, 3, 2, 1, 3, 3, 8, 3, 1, 1, 2, 1, 1, 1, 0, 0, 1, 1, 1, 0, 1, 3, 4, 7, 2
		3	16 598	38.7	3, 0, 1, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 3, 0, 1, 1, 4

Continued

Supplementary Table 5: Continued

Analysis	# Clusters (Silhouette Score)	Cluster ID	# Clients	% Clients	Medoid
	K = 4 (SS = 0.236)	1	998	2.3	7, 0, 3, 4, 1, 2, 2, 1, 1, 1, 1, 1, 1, 0, 1, 2, 1, 1, 0, 2, 2, 1, 6, 2, 3, 9, 20, 10, 13, 9, 12, 13, 2
		2	26 775	62.5	3, 0, 1, 0, 2, 0, 0, 0, 1, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 1, 1, 0, 1
		3	10 169	23.7	3, 2, 0, 0, 4, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 6, 2, 4, 2, 5, 1, 2
		4	4913	11.5	8, 5, 4, 3, 3, 2, 3, 4, 2, 4, 6, 4, 5, 4, 4, 5, 3, 7, 5, 4, 5, 4, 3, 3, 2, 4, 2, 7, 3
	K = 5 (SS = -0.031)	1	11 624	27.1	3, 2, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 2, 1, 0, 1, 0, 0, 0, 3, 1
		2	6981	16.3	2, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 5, 3, 0, 1, 0, 1, 0, 0, 0, 2, 1
		3	6448	15.0	6, 8, 3, 1, 1, 2, 3, 3, 3, 2, 6, 4, 1, 1, 3, 1, 2, 2, 0, 2, 2, 1, 2, 2, 3, 2, 2, 1, 2
		4	5840	13.6	4, 3, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 2, 4, 9, 5, 2
		5	11 962	27.9	2, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 1, 0, 2, 0, 0, 1, 0, 0, 0, 1

Notes: Short-term cohort includes clients with 2–3 years of observation; long-term cohort includes clients with 8–10 years of observation. Year represents consecutive 365.25 day intervals; quarter-year represents consecutive 90.30 day intervals. Medoids are the time series of a real client, and represent the "middle" time series for a cluster, i.e., selected to minimize within- and maximize between-cluster distance. *Legend:* SS = Silhouette Score. K represents the number of clusters allowed to explain the data.

Eleven-year period prevalence technical details

Since not all clients receive care from CHCs 2009–2019, they are not all at-risk of condition indications in their electronic health record for the entire calendar-based period of observation. Thus, the denominator requires estimation of the average or mid-point size of the population. This is challenging given that primary care electronic health records represent an open cohort with no standard expectation for frequency of care, and the overall number of clients receiving care increases across calendar time (see Supplementary Figure 1). We used the following process to calculate 11-year period prevalence:

Numerator: number of clients with at least one relevant code at any point from 2009 through 2019.

Denominator: First, we calculated the median number of calendar-based years of observation across all eligible clients (i.e., median number of "at-risk" years): 5 years. Second, we calculated the number of clients who received any type of care at least once in each of the seven possible five-year intervals (2009-13; 2010-14; 2011-15; 2012-16; 2013-17; 2014-18; 2015-19), representing the size of the population within each of those five-year intervals. Finally, the median size of those seven cohorts was used as the denominator, representing the overall average size of the population across 11 years.

The same process was followed to get estimates for the entire eligible population and for the subset of clients who receive care from urban at risk community health centres.