Ethnic differences in the use of prescription drugs in British Columbia: a cross-sectional analysis of linked survey and administrative data

Steven Morgan, Gillian Hanley, Colleen Cunningham, Hude Quan

Steve Morgan (morgan@chspr.ubc.ca) is Associate Professor in the UBC School of Population and Public Health, Associate Director of the UBC Centre for Health Services and Policy Research, and Lead of the Pharmaceutical Policy Research Collaboration (www.pharmaceuticalpolicy.ca). Gillian Hanley (ghanley@chspr.ubc.ca) is a doctoral candidate in the UBC School of Population and Public Health and graduate research assistant at the UBC Centre for Health Services and Policy Research. Colleen Cunningham (ccunningham@chspr.ubc.ca) is a Research Coordinator at the UBC Centre for Health Services and Policy Research. Dr. Hude Quan (hquan@ucalgary.ca) is an Alberta Heritage Foundation for Medical Research Population Health Investigator and an Associate Professor at the Department of Community Health Sciences and the Centre for Health and Policy Study of the University of Calgary.

1Corresponding author and guarantor
Steve Morgan, PhD
Associate Professor & Associate Director
UBC Centre for Health Services and Policy Research
#201 - 2206 East Mall
Vancouver, BC V6T 1Z3
Phone: 604-822-7012 / Email: morgan@chspr.ubc.ca

2Contributions statement
Steve Morgan conceived of the project and contributed to the design and acquisition of data; he oversaw data analysis, contributed to the interpretation of results, and was principal writer of the manuscript. Gillian Hanley contributed to project conception, design, acquisition of data; she conducted the data analysis, contributed to the interpretation of results, and all phases of manuscript writing. Colleen Cunningham helped implement the study, contributed to the analysis of data, interpretation of results, and manuscript revision. Hude Quan contributed to conception, design, interpretation of results, and revision of the manuscript. All of the authors approved the final version of the manuscript.

3Support
This study was funded by an operating grant (“Equity in pharmacare: the effects of ethnicity and policy in British Columbia”) from the Canadian Institutes of Health Research. The construction of the research database was supported, in part, by contributions of the BC Ministry of Health Services to the UBC Centre for Health Services and Policy Research. Sponsors had no role in the project or in decisions to publish results.

4Competing Interests
None

Word count = 2,263
Abstract = 232

2Abstract

1Background

Ethnic disparities in the use of medical and hospital care have been well documented but disparities in prescription drug use have not. We therefore conducted a cross-sectional analysis of survey and administrative data to study needs-adjusted rates of purchase of prescription drugs by British Columbia residents of differing self-identified ethnicity.

2Methods

For a sample of 19,370 BC residents, we linked Canadian Community Health Survey data on self-identified ethnicity with administrative data describing prescription purchases and medical services utilisation for 2005. We used sex-stratified multivariate logistic regressions to measure differences in the likelihood of purchasing prescriptions by drug class. Models were adjusted for age, general health status, treatment-specific health status, socioeconomic factors, and recent immigration.

3Results

We found evidence of significant needs-adjusted ethnic variation in the purchase of prescription drugs. Women and men who identified as South Asian or of mixed ethnicity purchased most types of medicine studied at rates comparable to women and men who identified as white but were more likely to purchase antibiotics and NSAIDs. Women and (to a lesser extent) men who identified as Chinese were less likely than those identifying as white to fill prescriptions for several types of drug.

4Interpretation

Some of the variations documented in this study suggest that ethnic differences in beliefs about pharmaceuticals may generate differences in prescription drug use; other variations suggest that there may be clinically important disparities in treatment utilization.

5

3Introduction

Although a difficult construct to work with empirically, ethnicity is an important marker of societal groupings for health care practice and policy because persons of different ethnic identities may have differing needs for, access to, and even outcomes from health care.[1] Racial and ethnic disparities in the use of medical and hospital care have been documented in Canada and comparable countries.[2-6] Disparities in prescription drug use have not been studied as thoroughly; however, evidence from the United States and Europe suggests that prescription drug use may vary by race and country of birth.[7-9]

From 1986 to 2006, the increased availability, promotion, and use of prescription drugs made then the fastest growing component of Canada's health system costs.[10] During that time, the ethnic composition of Canada's population changed significantly, with increases in the share of the population that is foreign born (from 16% to 20%) and the share of the population that is a visible minority (from 6% to 16%).[11] It is therefore important to understand whether and how pharmaceutical use differs across ethnic groups in Canada.

Existing evidence concerning ethnic disparities in health services may not necessarily extrapolate to the case of prescription drugs for a number of reasons. Because outpatient pharmaceutical benefits are not universal in Canada, disparities in access to prescription drugs may exist even if access to primary care is relatively equitable. Moreover, ethnic differences in beliefs about pharmaceuticals could generate differences in medicine use not reflected in the use of other health services. We therefore studied the purchases of prescription drugs by British

Columbia (BC) residents of differing self-identified ethnicity. We studied several therapeutic classes to test the hypothesis that, owing to the influences of personal beliefs, ethnic variations in prescription drug use will differ by the nature of treatment.

4Methods

1Cohort

Our study cohort was based on the 2001, 2003, and 2005 cycles of the Canadian Community Health Survey (CCHS). Conducted in English, French, or the interviewee's preferred language, the CCHS asks questions pertaining to a randomly selected person aged 12 or older per household drawn from a complex sample frame.[12] We studied BC respondents whose CCHS data could be linked to administrative health care datasets maintained by Population Data BC. The administrative datasets used do not include registered First Nations, veterans, inmates of federal penitentiaries, and Royal Canadian Mounted Police.

We focus on urban respondents in this study because ethnic minority groups are highly concentrated in those settings; the addition of rural populations would add neither statistical information nor reasonable comparisons. We excluded linkable CCHS respondents who identified as aboriginal because their administrative health care data may have been incomplete and therefore may have biased results. To ensure comparability of data for study subjects, we also excluded individuals with missing CCHS data, those who did not reside in BC for at least 275 days in 2005, and those who lived in areas with high rates of non-fee-for-service medical care. The last exclusion criterion was necessary because our health status measures draw, in

part, on diagnoses from fee-for-service medical claims data; high rates of non-fee-for-service care would bias health status measures. Finally, we eliminated individuals for which we had incomplete data. (See Appendix A for sample selection details.)

2Data

We identified all prescriptions filled during the 2005 calendar year by study subjects using the BC PharmaNet database. PharmaNet records every prescription dispensed in community pharmacies and long-term care facilities, regardless of patient age or insurance status. Our primary outcome measures were whether or not an individual filled one or more prescription in 2005 from three commonly used classes of medicine chosen to represent a range of treatment types: antihypertensives, oral antibiotics, and antidepressants. (See Appendix B for details regarding therapeutic categories.)

Our ethnicity measure was based on responses to the CCHS question “People living in Canada come from many different cultural and racial backgrounds. Are you:...?” Individuals could respond yes to one or more of 13 ethnicities read to respondents by Statistics Canada. We coded individuals who responded yes to more than one ethnic grouping as persons of mixed ethnicity and assigned those who responded yes to a single ethnic grouping into one of the following categories: Whites, Chinese, South Asians, other Asians, and non-Asian non-whites. (See Appendix C for details of ethnic groupings.) We also used the CCHS to identify recent immigrants, which we defined as respondents who immigrated to Canada within 10 years of 2005 (our observation year).

To measure health status, we constructed Aggregated Diagnostic Groups (ADGs) and Expanded Diagnostic Clusters (EDCs) based on ICD-9 and ICD-10 codes drawn from records of all fee-for-services medical visits and hospital discharges during 2005.[13] A higher count of ADGs indicates a greater degree of overall clinical complexity and is predictive of increased likelihood of prescription drug use.[14] EDCs denote the diagnosis of specific clinical conditions; we used EDCs to identify common indications for each of the drug classes studied (see Appendix B). The EDCs included in each model were selected by practicing physicians and a clinical pharmacist for a previously published study of medicine use in BC.[15]

We used administrative records to construct household income quintiles based on a combination of household-specific and neighbourhood-level income data.[16] To adjust for possible differences in access to private insurance benefits, we identified all individuals living in households for which the family's provincial medical premiums was paid through a household member's employment. Such medical premium payment is an indicator of employment-related health benefits that often also includes private drug coverage.

3Statistical methods

We computed un-weighted, sex-stratified multivariate logistic regressions on our outcome variables. Informed by models of health services utilization and evidence concerning prediction of pharmaceutical use and costs, our models included age, health status, income, employment-related health benefits, and recent immigration. To allow for non-linear relationships between age and the likelihood of prescription purchases, we defined age using dummy variables for 10-year age groupings. Findings concerning ethnic variations were robust to the inclusion or exclusion of

variables that were not consistently statistically significant – namely, employment-related health benefits and recent immigration.

4Research support and ethics

This study was funded by an operating grant (“Equity in pharmacare: the effects of ethnicity and policy in British Columbia”) from the Canadian Institutes of Health Research. The construction of the research database was supported, in part, by contributions of the BC Ministry of Health Services to the UBC Centre for Health Services and Policy Research. Sponsors had no role in the project or in decisions to publish results. The de-identified data were provided by Population Data BC with permission of data stewards at the BC Ministry of Health Services and with the College of Pharmacists of BC. The study protocol was reviewed and approved by the UBC Behavioural Research Ethics Board.

5Results

The final sample for our study included 19,370 individuals – Table 1. People who identified as white were older, wealthier, less healthy, and less likely to have recently immigrated to Canada than people who identified with non-white ethnicities. Respondents of mixed ethnicity (85% of which replied yes to ‘White’ and a visible minority group) were younger, wealthier, and less likely to be an immigrant than single-ethnicity visible minorities. Crude rates of diagnose of conditions for which antihypertensives, antibiotics, and antidepressants are indicated varied by ethnicity, with the largest variation observed for diagnoses for which antidepressants are indicated. Crude rates of antihypertensive and antidepressant use were highest among white women and men, whereas use of antibiotics was highest among women and men of South Asian ethnicity.

When adjusted for age, health status, and socioeconomic factors, several ethnic disparities in the use of antihypertensives, antibiotics, and antidepressants remained – Table 2. Women identifying as Chinese were approximately half as likely to purchase an antihypertensive as comparable women identifying as white (OR=0.46, p<0.01); and Chinese men trended toward lower likelihood of purchasing antihypertensives than white men (OR=0.74, p=0.10). Other ethnic differences in the odds of an antihypertensive purchase were not statistically significant. South Asian men were approximately 50% more likely to purchase antibiotics than white men (OR=1.57, p<0.01); whereas Chinese women and non-Asian, non-white women had statistically significantly lower odds of purchasing antibiotics than white women. Several ethnic groups had significantly lower odds of purchasing antidepressants than comparable whites: including, Chinese women and men, Other Asian men and women, and non-Asian, non-white women.

Supplementary analyses found in Appendix D found several statistically-significant ethnic variations in the use of statins, respiratory drugs, and non-steroidal anti-inflammatory drugs (NSAIDs): Chinese men had lower adjusted odds of purchasing statins than white men (OR=0.57, p=0.01); Chinese women had lower adjusted odds of purchasing respiratory medicines than white women (OR=0.37, p<0.01); and South Asian women and men had higher adjusted odds of purchasing NSAIDs than white women and men (women's OR=1.46, p=0.04; men's OR=1.61, p=0.01).

6Limitations

Although this study combines the benefits of self-reported ethnic identity with administrative data on medicine purchases, quantitative analysis of observational

data can only provide a generalized account of the complex personal and social dimensions of ethnicity.[17] Our measure of medicine use is based on the purchase of prescription drugs, which does is not guarantee that the medicines were actually taken as prescribed or at all. Rates of prescription purchase are, however, a better indicator of actual utilization than rates of prescribing. Prescriptions written by doctors may not be filled by patients due to cost, beliefs, or reasons. Some of the ethnic differences in medicine purchases identified in this study may have been due to ethnic differences in rates at which prescriptions written by practitioners are filled by patients.

Having pooled CCHS data across multiple years, we were unable to use self-reported health status and health care use information from the survey because such measures are not time-invariant (the immigration and ethnicity variables, in contrast, are arguably time-invariant). We were, however, able to link self-reported ethnicity data to administrative health care data that is not subject to recall or social-desirability biases that might otherwise bias measurement of needs and medicine use. The linkage of three cycles of the CCHS data to administrative records produced a sample that, despite having a higher percentage of ethnic minorities than samples of the CCHS used in other studies,[6] under-represents immigrants and non-white ethnicities in BC when compared to Census data.[11] A larger, linkable source of ethnicity data may reduce confidence intervals around point estimates and thereby result in statistical significance of ethnic variations that appear clinically important but were not statistically significant in the present study (e.g., use of antihypertensives and statins by South Asians).

7Interpretation

Using linked survey and administrative data on urban-dwelling BC residents, we found evidence of statistically significant ethnic variation in the use of prescription drugs even after ethnic differences in age, health status, socioeconomic characteristics, and recent immigration were accounted for. People of South Asian and mixed ethnicity were about as likely as whites to use most classes of medicines studied and were more likely to use antibiotics (table 2) and NSAIDs (Appendix D). Women and (to a lesser extent) men from BC who identify as Chinese appear to be less likely than those identifying as white to fill prescriptions for several types of drug. Overall, ethnic disparities were greater among women than men, suggesting that gender roles, relationships, and institutions may modify the effects of ethnicity on patient and/or provider behaviour. These findings are likely to generalize to other urban settings in Canada.

Differences in the use of medicines across ethnic groups could result from differences in access to medical care,[2-6] burdens of illness,[18-19] beliefs about medicines,[20] or communications with practitioners.[21] The pattern of findings across the drug classes studied here suggests that some utilization differences may stem from beliefs and preferences about the use of prescription drugs versus other treatment options. We found the greatest degree of ethnic variation in the use of antidepressants, which may be a category of medicines for which cultural beliefs about health and treatment affect patient choices. Patients of differing ethnicity may present differently when suffering from depression or anxiety; immigrants to Canada may also choose seek care through other sources, including from visits to their county of birth.[22] It is potentially encouraging that ethnic disparities in the adjusted odds of using antihypertensives (table 2) and statins (Appendix D) were

smaller than such differences in the other classes; nevertheless, there appear to be ethnic differences of potential clinical significance in such essential drug classes, particularly for persons of Chinese ethnicity. The source of such differences may not be limited to patient preference: a telephone survey of residents in Vancouver (the largest urban area of BC) found that Chinese immigrants to Canada are less likely than persons of other ethnicity to receive patient education about heart disease from their health care providers.[21]

Despite a relatively equitable system of health care financing in Canada, there appear to be significant ethnic differences in prescription drug use. Some of these – such as marked ethnic variation in the use of antidepressants – may reflect acceptable differences resulting from patient preferences and beliefs; others may reflect unacceptable inequities in quality care and resulting outcomes. Further research is needed to separate the former from the latter. The differences in patterns of medicine use that we observed across ethnic groups in BC suggest that simple comparisons between whites and a singular “visible minority” group should be avoided wherever possible in future research. Moreover, our sex-specific findings suggest that gender and ethnicity interact in ways that are potentially important for health care practice and policy. To address these important issues with quality scientific evidence will require more routine collection of and research on information concerning ethnicity and health care in Canada.

Table 1: Descriptive statistics of study sample

	Women						Men					
	White	Chinese	South Asian	Other Asian	Non-Asian Non-White	Mixed ethnicity	White	Chinese	South Asian	Other Asian	Non-Asian Non-White	Mixed ethnicity
N	9,205	683	260	348	218	151	7,069	625	266	226	207	112
Average age	51.8	43.4	40.3	42.9	43.4	39.0	49.9	41.8	42.3	42.0	42.1	36.1
Average # of ADGs	4.3	3.5	4.2	3.5	4.1	4.0	3.2	2.5	3.8	2.6	3.2	2.8
% recently immigrated	1.1%	32.7%	21.9%	27.6%	27.5%	2.7%	1.7%	30.4%	21.8%	27.9%	21.7%	1.8%
% in lowest income quintile	21.4%	34.8%	27.5%	26.2%	36.2%	22.1%	13.8%	29.6%	17.2%	26.8%	31.7%	22.8%
% in highest income quintile	20.1%	13.4%	11.8%	14.0%	11.1%	19.1%	25.5%	16.9%	19.9%	15.6%	12.6%	21.8%
% with employment benefits	47.3%	30.9%	41.8%	41.9%	37.2%	39.7%	49.4%	32.6%	38.0%	39.8%	33.3%	34.8%
% with diagnoses of one or more condition that is a primary indication for...												
Antihypertensives	32.2%	21.2%	22.3%	20.7%	21.1%	18.5%	31.8%	22.7%	30.1%	28.8%	23.7%	22.3%
Antibiotics	36.8%	35.6%	45.4%	40.4%	38.5%	37.8%	26.8%	34.4%	44.0%	30.1%	31.9%	29.5%
Antidepressants	22.5%	11.6%	14.6%	13.8%	22.9%	17.9%	12.7%	5.0%	9.4%	7.1%	12.1%	17.0%
% that purchased...												
Antihypertensives	26.6%	13.2%	14.2%	14.8%	14.2%	11.3%	23.0%	13.6%	16.2%	18.6%	15.9%	11.6%
Antibiotics	40.4%	32.2%	44.8%	35.9%	35.3%	37.8%	30.4%	28.0%	47.4%	25.2%	33.3%	32.1%
Antidepressants	19.8%	5.0%	12.3%	5.1%	12.4%	17.9%	9.0%	0.8%	7.5%	2.7%	5.3%	6.3%

Note: See Appendix for specific conditions included as indications for each type of treatment

Table 2: Adjusted odds ratios for the purchase of antihypertensives, antibiotics and antidepressants by persons of different self-identified ethnicity

	Women	Men
Antihypertensives		
White	1.00 (ref)	1.00 (ref)
Chinese	**0.46 (0.32, 0.65)**	0.74 (0.52, 1.06)
South Asian	0.77 (0.45, 1.32)	0.71 (0.43, 1.18)
Other Asian	0.85 (0.55, 1.33)	1.57 (0.96, 2.57)
Non-Asian, Non-White	0.66 (0.38, 1.13)	0.86 (0.48, 1.55)
Mixed ethnicity	0.53 (0.25, 1.12)	0.94 (0.43, 2.06)
Antibiotics		
White	1.00 (ref)	1.00 (ref)
Chinese	**0.71 (0.57, 0.89)**	0.84 (0.67, 1.05)
South Asian	1.08 (0.79, 1.47)	**1.57 (1.16, 2.12)**
Other Asian	0.90 (0.68, 1.18)	**0.67 (0.46, 0.97)**
Non-Asian, Non-White	**0.60 (0.42, 0.87)**	1.10 (0.77, 1.56)
Mixed ethnicity	0.85 (0.56, 1.28)	0.97 (0.60, 1.58)
Antidepressants		
White	1.00 (ref)	1.00 (ref)
Chinese	**0.29 (0.20, 0.42)**	**0.11 (0.04, 0.28)**
South Asian	0.80 (0.53, 1.23)	0.94 (0.55, 1.61)
Other Asian	**0.31 (0.19, 0.52)**	**0.31 (0.12, 0.77)**
Non-Asian, Non-White	**0.59 (0.37, 0.94)**	0.51 (0.25, 1.03)
Mixed ethnicity	1.23 (0.76, 1.99)	0.45 (0.19, 1.09)

Note: models are adjusted for age (10-year age bands), general health status (Aggregated Diagnostic Groups), treatment-specific indications of potential need (Expanded Diagnostic Clusters outlined in Appendix B), income quintiles, evidence of employment-related health benefits, and recent immigration (within 10 years).

8References

1. Bhopal R. Revisiting race/ethnicity as a variable in health research. American Journal of Public Health 2002;92(2):156-157.
2. Sproston KA, Pitson LB, Walker E. The Use of Primary Care Services by the Chinese Population Living in England: examining inequalities. Ethnicity & health 2001;6(3):189-196.
3. Mayberry RM, Mili F, Ofili E. Racial and ethnic differences in access to medical care. Medical care research and review 2000;57:108.
4. Fiscella K, Franks P, Doescher MP, Saver BG. Disparities in Health Care by Race, Ethnicity, and Language Among the Insured: Findings From a National Sample. In; 2002. p. 52.
5. Yu SM, Huang ZJ, Singh GK. Health Status and Health Services Utilization Among US Chinese, Asian Indian, Filipino, and Other Asian/Pacific Islander Children. Pediatrics 2004;113(1):101-107.
6. Quan H, Fong A, De Coster C, Wang J. Variation in health services utilization among ethnic populations. Canadian Medical Association.Journal 2006;174(6):787.
7. Hahn BA. Children's health: racial and ethnic differences in the use of prescription medications. In: Am Acad Pediatrics; 1995. p. 727-732.
8. Wang J, Noel JM, Zuckerman IH, Miller NA, Shaya FT, Mullins CD. Disparities in Access to Essential New Prescription Drugs between Non-Hispanic Whites, Non-Hispanic Blacks, and Hispanic Whites. Medical Care Research & Review 2006;63(6):742.
9. Ringbäck Weitoft G, Ericsson Ö, Löfroth E, Rosén M. Equal access to treatment? Population-based follow-up of drugs dispensed to patients after acute myocardial infarction in Sweden. European Journal of Clinical Pharmacology 2008;64(4):417-424.
10. CIHI. National Health Expenditure Trends, 1975 to 2009. Ottawa: Canadian Institute for Health Information; 2009.
11. Statistics Canada. Canada's Ethnocultural Mosaic, 2006 Census. Ottawa: Statistics Canada; 2008.
12. Béland Y. Canadian community health survey--methodological overview. Health Reports 2002;13(3):9-14.
13. Weiner JP, Starfield BH, Steinwachs DM, Mumford LM. Development and application of a population-oriented measure of ambulatory care case-mix. Medical Care 1991;29(5):452-72.
14. Hanley GE, Morgan S, Reid RJ. Explaining Prescription Drug Use and Expenditures Using the Adjusted Clinical Groups Case-Mix System in the Population of British Columbia, Canada. Medical Care 2010;48(5):402-408 10.1097/MLR.0b013e3181ca3d5d.
15. Morgan S, Cunningham C, Hanley G, Mooney D. The BC Rx Atlas, 2nd Edition. Vancouver: Centre for Health Services and Policy Research; 2009 September.
16. Hanley G, Morgan S. On the validity of area-based income measures to proxy household income. BMC Health Services Research 2008;8(1):79.
17. Bhopal R. Race and ethnicity: Responsible use from epidemiological and public health perspectives. Journal of Law Medicine & Ethics 2006;34(3):500-+.

18. Chiu M, Austin PC, Manuel DG, Tu JV. Comparison of cardiovascular risk profiles among ethnic groups using population health surveys between 1996 and 2007. CMAJ 2010:cmaj.091676.
19. Creatore MI, Moineddin R, Booth G, Manuel DH, DesMeules M, McDermott S, et al. Age- and sex-related prevalence of diabetes mellitus among immigrants to Ontario, Canada. CMAJ 2010:cmaj.091551.
20. Lin SS, Kelsey JL. Use of race and ethnicity in epidemiologic research: Concepts, methodological issues, and suggestions for research. Epidemiologic Reviews 2000;22(2):187-202.
21. Grunau GL, Ratner PA, Galdas PM, Hossain S. Ethnic and gender differences in patient education about heart disease risk and prevention. Patient Education and Counseling 2009;76(2):181-188.
22. Marshall E, Wong S, Haggerty J, Levesque J-F. Perceptions of unmet healthcare needs: what do Punjabi and Chinese-speaking immigrants think? A qualitative study. BMC Health Services Research 2010;10(1):46.

9Appendix A

Figure 1 : Sample description information

10Appendix B

Table 3: Drug types and diagnoses included by therapeutic categories studied

Category	Drug types	Specific Expanded Diagnostic Clusters (EDCs) used as treatment-specific indicators of potential need
Antihypertensives	• Thiazide diuretics (e.g. hydrochlorothiazide) • Beta blocking agents (e.g. atenolol) • Calcium channel blockers (e.g. nifedipine) • Angiotensin converting enzyme inhibitors (e.g. ramipril) • Angiotensin receptor blockers (e.g. losartan)	• CAR14: Hypertension, w/o major complications • CAR15: Hypertension, with major complications • CAR01: cardiovascular signs and symptoms • CAR03: Ishemic heart disease • CAR05: Congestive heart failure • CAR07: Cardiomyopathy • CAR10: Generalized atherosclerosis • CAR12: Acute myocardial infarction • END06: Type 2 diabetes, w/o complication • END07: Type 2 diabetes, w/ complication • END08: Type 1 diabetes, w/o complication • END09: Type 1 diabetes, w/ complication
Antidepressants	• Nonselective monoamine reuptake inhibitors (e.g. amitriptyline) • Monoamine oxidase inhibitors (e.g. phenelzine) • Trazodone • Selective serotonin reuptake inhibitors (e.g. citalopram) • Venlafaxine • Mirtazapine • Moclobamide • Bupropion	• PSY01: Anxiety, neuroses • PSY09: Depression • PSY10: Psychological signs and symptoms

Category	Drug types	Specific Expanded Diagnostic Clusters (EDCs) used as treatment-specific indicators of potential need
Antibiotics	• Penicillins, (e.g.amoxicillin) • Sulfa drugs (e.g. trimethoprim / sulfamethoxizole) • Cephalexin • Tetracyclines (e.g. doxycycline) • Erythromycin • Clindamycin • Metronidazole • Nitrofurantoin • Amoxcillin /clavulanate • Fluoroquinolones (e.g. ciprofloxacin) • Macrolides (e.g.azithromycin) • Second and third generation cephalosporins (e.g. cefuroxime) • Linezolid • Vancomycin	• EAR01: Otitis media • EAR11: Acute upper respiratory tract infection • EYE09: Infections of the eyelid • GSI03: Fever • GSU09: Nonfungal infections of skin and subcutaneous tissue • GUR08: Urinary tract infections • GUR10 Prostatitis • INF05 Sexually transmitted diseases • INF08: septicemia • INF09 infections, other • RES02: Acute lower resiratory tract infection • RES07: Sinusitis • SKN19: Impetigo
Statins	• Statins (e.g. atorvastatin)	• CAR11: Disorders of lipoid metabolism • CAR12: Acute myocardial infarction • CAR03: Ishemic heart disease • NUR05: Cerebrovascular disease • CAR10: Generalized atherosclerosis
Inhaled drugs for respiratory conditions	• Inhaled adrenergics (e.g. salbutamol, salmeterol) • Inhaled glucocorticoids (e.g. fluticasone) • Inhaled anticholinergics (e.g. ipratropium)	• RES04: emphysema, chronic bronchitis, COPD • RES01: Respiratory signs and symptoms • ALL04: Asthma, w/o status asthmaticus • ALL05: Asthma, w/ status asthmaticus
Nonsteroidal Anti-inflammatory drugs (NSAIDs)	• Cyclooxgenase-2 (COX2) inhibitors brand (e.g. celecoxib) • COX-2 inhibitors generic (diclofenac, etodolac, meloxicam) • Older NSAIDs (e.g. naproxen)	• RHU01: Autoimmune and connective tissue diseases • RHU02: Gout • RHU03: Arthropathy • NUR02: Headaches • MUS02: Acute sprains and strains • MUS03: Degenerative disc disease • MUS04 Fractures • MUS 08: Fractures and dislocations • MUS09: Joint disorders, trauma related • MUS10: Fracture of neck of femur • MUS13: cervical pain syndrome • MUS14: low back pain • MUS15: Bursitis, synovitis, tenosynovitis • MUS17: musculoskeletal disorders, other

11Appendix C

Table 4 : Ethnic groupings derived from Canadian Community Health Survey (CCHS) data

Ethnic groupings as read in the CCHS questionnaire	Ethnic groupings used in the present study	Sample included in the present study
White	White	16,260
Chinese	Chinese	1,308
South Asian (e.g. East Indian, Pakistani, Sri Lankan)	South Asian	527
Filipino	Other Asian	222
South East Asian (e.g. Cambodian, Indonesian, Laotian, Vietnamese)		126
Japanese		129
Korean		101
Black	Non-Asian, Non-White	49
Latin American		68
Arab		22
West Asian (e.g. Afghan, Iranian)		72
Other		214
More than one of the above ethnicities	Mixed	263

12Appendix D

Table 5 : Adjusted odds ratios for the purchase of statins, respiratory drugs, and non-steroidal anti-inflammatory drugs by persons of different self-identified ethnicity

	Women	**Men**
Statins		
White	1.00 (ref)	1.00 (ref)
Chinese	0.71 (0.48, 1.05)	**0.57 (0.39, 0.84)**
South Asian	0.59 (0.29, 1.19)	1.00 (0.63, 1.58)
Other Asian	1.17 (0.73, 1.87)	1.24 (0.74, 2.06)
Non-Asian, Non-White	0.60 (0.29, 1.22)	1.04 (0.61, 1.77)
Mixed ethnicity	1.54 (0.76, 3.15)	0.52 (0.18, 1.53)
Respiratory drugs		
White	1.00 (ref)	1.00 (ref)
Chinese	**0.37 (0.22, 0.62)**	0.98 (0.62, 1.55)
South Asian	0.55 (0.29, 1.05)	1.07 (0.61, 1.88)
Other Asian	0.89 (0.52, 1.51)	1.36 (0.71, 2.59)
Non-Asian, Non-White	0.97 (0.53, 1.77)	0.93 (0.44, 1.95)
Mixed ethnicity	0.83 (0.41, 1.71)	0.84 (0.33, 2.18)
NSAIDs		
White	1.00 (ref)	1.00 (ref)
Chinese	0.78 (0.58, 1.04)	0.91 (0.66, 1.25)
South Asian	**1.46 (1.03, 2.08)**	**1.61 (1.13, 2.31)**
Other Asian	0.97 (0.68, 1.38)	1.22 (0.78, 1.92)
Non-Asian, Non-White	1.17 (0.77, 1.78)	1.19 (0.75, 1.87)
Mixed ethnicity	1.20 (0.74, 1.96)	1.16 (0.60, 2.26)

Note: models are adjusted for age (10-year age bands), general health status (Aggregated Diagnostic Groups), treatment-specific indications of potential need (Expanded Diagnostic Clusters outlined in Appendix B), income quintiles, evidence of employment-related health benefits, and recent immigration (within 10 years).

13 Appendix E

Table 6 : STROBE Statement checklist

	Item No	Recommendation	Done
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	➳
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	➳
Objectives	3	State specific objectives, including any prespecified hypotheses	➳
Methods			
Study design	4	Present key elements of study design early in the paper	➳
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	➳
Participants	6	Cross-sectional study—Give the eligibility criteria, and the sources and methods of selection of participants	➳
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	➳
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	➳
Bias	9	Describe any efforts to address potential sources of bias	➳
Study size	10	Explain how the study size was arrived at	➳
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	➳
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) Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	➳
		(e) Describe any sensitivity analyses	➳
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg 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	➳
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	➳
		(b) Indicate number of participants with missing data for each variable of interest	n/a
Outcome data	15*	Cross-sectional study—Report numbers of outcome events or summary measures	➳
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 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	➳
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	➳
Discussion			
Key results	18	Summarise key results with reference to study objectives	➳
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	➳

Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	➳
Generalisability	21	Discuss the generalisability of the study results	➳
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	➳