DOES CONCORDANCE BETWEEN SURVEY RESPONSES AND ADMINISTRATIVE RECORDS DIFFER BY ETHNICITY FOR PRESCRIPTION MEDICATION?

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ABSTRACT

Background
Self-reported prescription medication use data is often used to measure differences across ethnic groups, but its accuracy may differ across ethnic groups.

Objective
We compared ethnic groups' self-reported medication use to their administrative records for respondents with diabetes, hypertension, and asthma.

Methods
We linked the Canadian Community Health Survey to administrative prescription drug records for 17,191 respondents in British Columbia, Canada. We evaluated the concordance between self-reported medication use and prescription drug records using positive predictive value, negative predictive value, sensitivity, specificity, and kappa statistic for self-identified Whites, Chinese, South Asians, and Southeast Asians/Filipinos. The concordance was calculated using prescription drug records as the reference standard. We also estimated the odds of disagreement (either a false positive or negative) in medication use with logistic regressions for each ethnic group, and compared them using the Blinder-Oaxaca method.

Results
We found that Chinese had the worst positive predictive value for asthma medication use at 0.41, while South Asians had the worst sensitivity for hypertension medication use at 0.60. The difference in reporting an error between ethnic groups was likely explained by differences in respondent characteristics. Particularly, if White respondents had the same characteristics as South Asians, then White respondents would have had 1.031 (95% CI: 1.020-1.041) higher odds of disagreement for hypertension medication use than with their own characteristics.

Conclusion
Self-reported medication use may be a valid measure of ethnic groups' medication use if ethnic differences in characteristics, like household income are held constant. However, an important determinant of validity for all ethnic groups is whether medications are used routinely, or for a specific episode.

Key Words: *Ethnicity, prescription medication use, health surveys, concordance*

A growing body of research has focused on racial and ethnic disparities in prescription medication use.[1-10] Many of the studies use self-reported data because of its availability in national surveys relatively low cost. It has, however, been questioned whether the accuracy of self-reported information differ across ethnicities. Inaccurate self-reported medication use makes it difficult to develop policies and programs for ethnic groups, and to eventually measure their impact on ethnic disparities.

Self-reported data introduces several sources of potential bias. Ethnic groups may differ substantially in their beliefs about health and health treatment.[11] Their beliefs may influence the frequency of their prescription medication use, which influences their ability to recall use. Ethnic groups may also differ in their views on privacy. In particular, some ethnic groups may be more hesitant to reveal their medication use than other ethnic groups for illnesses that are stigmatized within their culture, like depression.[12] Finally, differences in language comprehension may influence the interpretation of survey questions and time-frames.[12]

Ethnic differences in the validity of self-reported health status and medical conditions are well-documented.[13,14] Examples of the differences for Chinese respondents, in particular, were that they were more likely to report fair or poor health status than White respondents even though they reported better health status for other health measures.[15] In addition, Chinese respondents were more likely to choose midpoints for Likert-type scales than White respondents.[16] Ethnic differences in the validity of self-reported health care utilization are less well-documented.[17,18] Reijneveld found that the validity of self-reported data was fair for hospitalizations, physiotherapy, and prescription drugs, and did not differ significantly across ethnic groups.[18]

The validity of self-reported medication use is particularly a concern because medication use tends to be less salient than health services like hospitalizations, which can result in lower recall accuracy. Further, the validity may differ substantially across ethnic groups. Uiters, et al[17] found that respondents of Moroccan and Turkish descent were more likely to over-report medication use than respondents of Dutch descent. However, it remains unknown whether the same ethnic differences in self-reported medication use exist for ethnic groups in North America, where research has mainly focused on ethnic groups such as Hispanics, Blacks, and Asians.[2,4,6] Similarly, research tends to aggregate medication types which may mask important differences in medication use across ethnic groups.[2,4,5,7]

The purpose of this study was to compare the concordance of self-reported medication use to prescription medication records for ethnic groups in British Columbia, Canada. Using a national health survey linked to a population-based prescription dispensation dataset, we evaluated the agreement between self-reported and administrative measures of medication use for three common medical conditions, diabetes, hypertension, and asthma. Further, we estimated the association between ethnicity and likelihood of disagreement in medication use.

METHODS

Study Population

The study population included British Columbia (BC) respondents for two cycles of Statistics Canada Canadian Community Health Survey (CCHS) – conducted in 2003 and 2005. CCHS questioned one randomly selected person aged 12 or older per household using a complex survey method.[19,20] Briefly, Statistics Canada sampling ensured that each province's sample is proportional to the population of each health region. The response rate for CCHS 2.1 and CCHS 3.1 was 81.2% and 77.3%, respectively in British Columbia for the total sample.[21,22]

The two survey datasets were linked to administrative health care datasets for the 2003 and 2005 calendar years. The administrative datasets included records from every prescription dispensed from community pharmacies and long-term care facilities in BC, as well as diagnostic information from every hospitalization and fee-for-service medical visit. The linked study population excluded all First Nation residents, veterans, inmates of federal penitentiaries, and Royal Canadian Mounted Police (approximately

4% of all BC residents eligible for provincially administered, universally public health insurance), hospitalized or institutionalized patients unable to participate in the CCHS, respondents with missing values for the below variables (42 respondents (0.24%)), respondents who did not provide permission to link their information with provincial health information, and residents who did not reside in BC for at least 275 days in 2003 and 2005. The last exclusion criterion ensured that respondents had complete prescription drug records. The final sample represented 17,191 respondents.

Variable Definitions

Self-reported medication use represented respondents who reported positively in the CCHS to using medication and having a medical condition. In particular, the respondents answered “Yes” to “In the past 12 months, have you taken any medicine for this condition?” and “Do you have this condition?” We chose this definition because of a difference in questioning between the two survey cycles. CCHS 3.1 asked the medication use question for only respondents who had agreed to have the corresponding medical condition, so all respondents not having the condition are classified as not using the medication. In contrast, all CCHS 2.1 respondents were asked the medication use questions. Thus, to make the survey cycles comparable, we classified all respondents in CCHS 2.1, who reported not having the medical condition but using the medication, as not using the medication, which affected 307 (1.79%) respondents.

We defined the criterion standard for medication use as whether or not a respondent filled one or more relevant prescriptions in the corresponding survey year (2003 or 2005) in the BC PharmaNet database. We did not restrict the definition to only those with the medical condition. This allowed us to determine whether CCHS’s conditional questioning resulted in a significant number of false negatives (please refer to the Appendix for further details). We classified prescription drugs using standard Anatomical Therapeutic Chemical (ATC) classifications with the exception that our “hypertension” category combined ATC groupings for diuretics, beta blockers, calcium channel blockers, ACE-inhibitors, and angiotensin II receptor blockers.[23] The “asthma” category represented ATC groupings for inhaled adrenergics, inhaled glucocorticoids, inhaled anticholinergics, and combinations (e.g., salmeterol/fluticasone). The “diabetes” category represented ATC groupings for metformin, sulphonylureas, glitazones, meglitinides, acarbose, and insulin. We constructed ethnic categories based on responses to the CCHS question “People living in Canada come from many different cultural and racial backgrounds. Are you:...?” We examined the four leading ethnicities in British Columbia: White, Chinese, South Asian, and Southeast Asian /Filipino. Other key variables were household income and health status. To define household income, we used tax return records from the Canadian Revenue Agency. BC has an income-based prescription drug program, which bases its co-insurance on residents’ household income. To determine the level of subsidy to which an individual is entitled, BC Fair PharmaCare collects household income information from a registrants’ income tax return information collected by the Canada Revenue Agency. This income information is validated and updated on a yearly basis. This information is only available if at least one member of the household voluntarily registered for the income-based program. Seventy-eight percent of households in our cohort had registered for income-based PharmaCare. For the remaining households, we used the average household income for their Census Dissemination Area (CDA), which varied across 7000 CDAs. We used a binary variable to represent respondents with household income equal or greater than the median household income. Respondents with missing household income information (344 (2%)) were categorized as zero in the binary variable. To measure health status, we constructed Aggregated Diagnostic Groups (ADGs) using the Johns Hopkins Adjusted Clinical Groups Case-Mix System based on ICD-9 and ICD-10 codes drawn from records of all fee-for-services medical visits and hospital discharges.[24] A higher count of ADGs indicated an increasing degree of overall clinical complexity and was found predictive of prescription drug use.[25]

Statistical Analysis

For each medication type, we measured agreement between self-reported and administrative records of medication use using the sensitivity, specificity, negative predictive value, positive predictive value, and kappa statistics.

With prescription medication as the reference standard, we calculated each statistic to measure different aspects of agreement. Sensitivity measured the proportion of respondents correctly indicating medication use among those who filled a prescription medication. Specificity measured the proportion of respondents correctly indicating no medication use among those who did not fill a prescription medication. NPV measured the proportion of respondents correctly indicating no medication use among those who did not report medication use. PPV measured the proportion of respondents correctly indicating medication use among those who reported medication use. Kappa statistic measures inter-rate agreement but corrects for chance agreement.[26] We also estimated the likelihood of reporting an error for each medication type with logistic regressions, and adjusted for characteristics that are potential sources of disagreement. The dependent variable was a binary variable that indicated disagreement. In particular, it represented respondents who reported medication use for a condition but did not fill any prescriptions, or respondents who reported no medication use for a condition but filled one or more prescriptions.

We modeled disagreement separately for each of the four ethnic groups studied. Estimating separate regressions for each ethnic group is equivalent to estimating a pooled regression with interaction terms for all ethnic groups and covariates (such as age, sex, immigrant status). If the interaction terms are restricted to equal zero, then it is assumed that each characteristic had the same effect on disagreement for all ethnic groups. We relaxed this assumption by estimating separate regressions: for example, separate regressions allowed for Chinese immigrants to have a different odds ratio of disagreements than White immigrants. We jointly tested whether the odds ratios statistically differed between Whites and another ethnic group with a Chow test. The characteristics included in the models were age, age-squared, sex, immigrant status, years since immigration, high income, survey cycle indicator, and health status (sum of ADGs). The survey cycle indicator variable accounted for systematic differences in disagreement between CCHS 2.1 and 3.1, which may be attributed to differences in the structure of questions, interviewer selection, or survey year.

We used the Blinder-Oaxaca method to compare the separately estimated odds ratios for Whites to each of the 3 ethnic groups' odds ratios.[27-30] The method decomposed the difference in predicted odds of disagreement between Whites and another ethnic group to two components. The first component measured the predicted difference in odds of disagreement if Whites had the same characteristics as the ethnic comparators relative to their own characteristics – this is roughly comparable to indirect standardization. It can be interpreted as the difference in disagreement attributable to differences in observable characteristics (e.g. age, sex, health status). The second component measured the predicted difference in odds of disagreement if the comparator ethnic group was fitted with Whites' odds ratios relative to their own odd ratios – this is roughly comparable to direct standardization. This second component has been typically interpreted as the difference in disagreement attributable to unmeasured differences in ethnicity, such as culture and preferences.[7,29]

RESULTS

Table 1 shows the percentage of medication use by ethnic group. Comparisons between self-reported and prescription drug records data showed that self-reported data underreported medication use for all ethnic groups and medication types. Self-reported data underreported medication use the least for diabetes and the most for hypertension. Although self-reported data underreported medication use, the differences between ethnic groups remained the same between the two data sources, e.g., both data sources showed that South Asians used the most diabetes medication. Table 1 also shows that South Asian respondents reported the most disagreement for all conditions except hypertension. In contrast, Chinese respondents reported the most agreements for all conditions. The study population's characteristics showed that Southeast Asians/Filipinos had the lowest average age (38.95), and highest female proportion (62.98%). Whites had the highest average age (51.06), highest proportion with high income (51.12%), lowest immigrant proportion (16.82%), and lowest average number of years since immigration (6.45).

TABLE 1 Descriptive Statistics for Medication Use Definitions and Characteristics of the Study Population by Ethnicity

	Whites n = 15563	**Chinese** n = 955	**South Asians** n = 384	**SE Asian/ Filipino** n = 289
Overall (%)	87.36	5.36	2.16	1.62
Medication Use Definitions				
CCHS Definition				
Hypertension (%)	16.18	10.79	8.33	10.38
Asthma (%)	6.63	2.83	4.95	3.81
Diabetes (%)	4.54	3.14	6.51	4.84
Prescription Drug Records Definition				
Hypertension (%)	23.87	13.19	13.02	14.53
Asthma (%)	8.73	3.04	8.07	4.84
Diabetes (%)	5.01	3.56	7.29	5.19
Proportion Reporting Medication Use Error				
Hypertension (%)	8.57	3.87	5.73	4.84
Asthma (%)	6.29	3.56	7.81	5.19
Diabetes (%)	0.87	0.84	1.30	1.73
Characteristics				
Average Age	51.06	42.79	40.83	38.95
Average Age-Squared	3021.49	2204.34	2007.20	1763.45
Female (%)	55.42	53.61	47.14	62.98
Average ADG	3.70	3.03	3.86	3.30
Immigrant Status (%)	16.82	84.61	74.22	82.70
Average Number of Years Since Immigration	6.45	12.29	13.83	12.45
High Income (%)	51.12	36.75	45.57	50.17
Survey Cycle Indicator (CCHS 3.1 respondents) (%)	47.25	47.64	50.78	56.40

Notes: SE Asian denotes Southeast Asians, CCHS denotes Canadian Community Health Survey, and ADG denotes Aggregated Diagnostic Groups

Agreement in Medication Use Definitions

Table 2 shows that the sensitivity was the lowest agreement statistic while specificity was the highest agreement statistic for all medication types and ethnic groups. The low sensitivity implied that respondents were more likely to under report their medication use. Overall, the agreement was the highest for diabetes (the kappa statistic ranged from 0.82 – 0.90), while the lowest for asthma (the kappa statistic ranged from 0.36 – 0.56) regardless of ethnicity. For asthma medication use, both the PPV and sensitivity was low and varied significantly across ethnic groups. For example, Whites' asthma medication use had a PPV of 0.68, while Chinese's asthma medication use had a PPV of 0.41. The agreement was generally fair or high for both hypertension and diabetes medication use. Only the sensitivity for hypertension varied across ethnic groups. Notably, Whites did not have the highest sensitivity relative to all other ethnic groups for hypertension medication use, i.e., Chinese had the highest sensitivity at 0.76. Further, South Asians had the worse sensitivity for hypertension medication use at 0.60.

The Odds Ratios of Reporting an Error in Medication Use by Ethnicity

The odds ratio for each covariate varied significantly in magnitude and direction across the four ethnic groups and medication types. In particular, the odds ratios for immigrant status, years since immigration, high income, and survey cycle indicator were generally opposite in directions between Whites and the other 3 ethnic groups. For example, a 10 year increase in the years since immigration for Whites decreased the odds of reporting an error for asthma and diabetes medication by a predicted 0.963 and 0.919, respectively; but, the opposite relationship was found for the other 3 ethnic groups (please refer to the Appendix for full results). The Chow test showed that the difference in odds ratios between Whites and one of the 3 ethnic groups were statistically significant for 3 of the 9 logistic regressions at the 95% confidence level. In particular, the odds ratios for Southeast Asians/Filipinos were statistically different from Whites for diabetes and hypertension medication use.

The Blinder-Oaxaca Decomposition in Reporting an Error in Medication Use

Table 3 shows that the decomposition results from the Blinder-Oaxaca method. The row, "Predicted Difference" showed that the predicted differences in the odds of disagreement between Whites and the other ethnic groups were generally small, which varied from 0.985 to 1.048. The row, "Explained" showed that Whites had higher odds of disagreement for all medication types if they had the other ethnic group's observable characteristics. For example, if Whites had South Asians' or Southeast Asians'/Filipinos' characteristics, then Whites would have had 1.031 (95% CI: 1.020-1.041) or 1.043 (95% CI: 1.034-1.054) higher odds of disagreement for hypertension, than with their own characteristics. The results showed that if Whites had, for example, the other 3 ethnic groups' lower income, it would have increased their odds of disagreement.

The rows denoted by "Unexplained" showed the predicted difference in odds of disagreement if one of the 3 ethnic groups had Whites' odds ratios relative to their own odds ratios. We found that if Chinese had Whites' odds ratios for disagreement for hypertension and asthma medication use, they would have had higher odds of disagreement, i.e., 1.020 (95% CI: 1.004 - 1.036) and 1.017 (95% CI: 1.002 - 1.033) higher odds of disagreement. However, we found that if South Asians or Southeast Asians/Filipino had Whites' odds ratios, they would have had lower odds of disagreement for all medication types. The magnitudes were mostly small, where the largest odds ratio was 0.980 (95% CI: 0.953- 1.008) for South Asians' odds of disagreement for asthma medication. None of the differences in odds ratios were statistically significant at the 95% confidence level for South Asians and Southeast Asians/Filipinos.

TABLE 2 The Agreement between Self-Reported and Prescription Drug Records Medication Use Data by Ethnicity and Medication Type

Ethnicity	**Hypertension Drug**					**Asthma Drug**					**Diabetes Drug**				
	Sensitivity	Specificity	PPV	NPV	kappa	Sensitivity	Specificity	PPV	NPV	kappa	Sensitivity	Specificity	PPV	NPV	kappa
White	0.66	0.99	0.97	0.90	0.74	0.52	0.98	0.68	0.96	0.56	0.87	1.00	0.96	0.99	0.90
Chinese	0.76	0.99	0.93	0.96	0.82	0.38	0.98	0.41	0.98	0.37	0.82	1.00	0.93	0.99	0.87
South Asian	0.60	0.99	0.94	0.94	0.70	0.32	0.97	0.53	0.94	0.36	0.86	1.00	0.96	0.99	0.90
Filipino/SE Asian	0.69	1.00	0.97	0.95	0.78	0.36	0.98	0.45	0.97	0.37	0.80	0.99	0.86	0.99	0.82

TABLE 3 Blinder-Oaxaca Odds Ratio of Reporting an Error in Medication Use by Medication Type and Ethnicity

	Chinese			South Asian			Southeast Asian/ Filipino		
	OR	95 % CI		OR	95 % CI		OR	95 % CI	
Hypertension Drug									
Predicted Difference	**1.048**	**1.035**	**1.061**	**1.029**	**1.001**	**1.058**	**1.038**	**1.017**	**1.059**
Explained	**1.027**	**1.014**	**1.040**	**1.031**	**1.020**	**1.041**	**1.043**	**1.034**	**1.053**
Unexplained	**1.020**	**1.004**	**1.036**	0.998	0.972	1.025	0.995	0.974	1.016
Asthma Drug									
Predicted Difference	**1.028**	**1.016**	**1.040**	0.985	0.958	1.013	1.011	0.986	1.037
Explained	1.010	1.000	1.021	1.005	0.995	1.015	**1.012**	**1.001**	**1.022**
Unexplained	**1.017**	**1.002**	**1.033**	0.980	0.953	1.008	0.999	0.974	1.025
Diabetes Drug									
Predicted Difference	1.000	0.994	1.006	0.996	0.986	1.005	0.991	0.878	1.119
Explained	1.001	0.996	1.006	**1.002**	**1.001**	**1.003**	**1.003**	**1.002**	**1.005**
Unexplained	1.000	0.993	1.006	0.993	0.984	1.003	0.988	0.875	1.116

DISCUSSION

The validity of self-reported medication use is often questioned for ethnic groups given the number of potential biases.[12,31] We, however, found that the lack of concordance between self-reported medication use and administrative data records did not differ significantly by ethnicity after we adjusted for respondents' characteristics. In particular, respondent characteristics, like age, ADG and income likely explain ethnic differences in unadjusted agreement statistics. The literature shows mixed results on the importance of respondent characteristics. Only respondents' age and comorbidities have been found to be clearly associated with disagreement, which we also found in our results. The number of comorbidities may influence disagreement more than characteristics like ethnicity because it tends to increase the number of medication types, and consequently, the difficulty to recall medication use accurately.[12]

We also found that the medication type mattered for agreement. For all ethnic groups, the agreement was the highest for diabetes medication use, while the lowest for asthma medication use regardless of ethnicity. The difference in agreement between medication types is likely related to differences in the frequency of use, e.g., asthma medications tend to be used to treat acute symptoms, while diabetes medications tend to be taken routinely. The high agreement for self-reported diabetes medication use implies that differences in self-reported use across ethnic groups are unlikely attributable to disagreement. Thus, self-reported medication use may be a useful tool to accurately measure the progress in treatment for ethnic groups, like South Asians, who have been well-documented to have increased risk for type II diabetes.[32]

We, nevertheless, found significant underreporting in medication use regardless of medication type or patients' ethnicity. A source of underreporting was CCHS's conditional medication use questions. For example, many of the respondents who controlled their high blood pressure with medication reported not having the medical condition -and consequently, were not asked the medication use question. In addition, many respondents not asked the medication use question may have used the medications off-label. Surveys should not make the assumption that respondents without the medical condition also do not use the medication. Surveys should ask all respondents the medication use question to reduce the number of false negatives. Further, underreporting can be reduced if a 2-period timeframe method is used in the questioning.[12] In particular, accuracy may improve if respondents are, first, asked about medication use in a long-period timeframe, and then asked in a short-period timeframe. The method may help respondents remember the chronological order of their medication use, and help respondents distinguish use for different time-periods.

Our study has some important limitations. First, the number of respondents for each ethnic group was small (besides Whites), and consequently many of the odds ratios were not statistically significant. Second, respondents were asked to recall their medication use in the past month for hypertension and diabetes (not asthma). We did not know the month respondents were asked the medication use questions, so we can only measure respondents' prescription claims history for the past year. Nevertheless, many of the medication classes tend to be taken routinely for hypertension and diabetes, so the difference in timeframes may not be significant. Further, this limitation does not apply for the asthma medication use question because respondents were asked to recall their use in the past year. Third, prescription claims data represented the number of prescriptions filled rather than medications used by respondents, so differences in agreement may be attributable to differences in compliance. Fourth, sampling weights could not be used to adjust for the multistage stratified cluster sample because our sample only represents the respondents who agreed to have their survey responses linked to their provincial health information. Fifth, respondents may have responded positively to CCHS's medication use question because of their use of over/behind-the-counter (OTC/BTC) medication, which may result in disagreement with their prescription medication records. This may affect our results if the ethnic groups vary in their use of OTC/BTC medications. Finally, the definition of medication use for asthma with prescription claims data included conditions like chronic obstructive pulmonary disease (COPD), which may have lowered the agreement with the self-reported data.

In summary, we found that ethnicity did not influence self-reported medication use once other respondent characteristics are controlled for in the analysis. An important determinant of validity may be whether the medication was used routinely or for a specific episode. Further, the concordance may also improve if the structure of survey questions helps respondents recall medication use.

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Conflict of Interest

None declared

Contributions

The manuscript was conceived jointly by the two authors. The analysis, interpretation and drafting were done by Dr. Lawrence So, but designed and revised by Drs. Steve Morgan and Hude Quan.

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