High Health Care Utilization and Costs Associated with Lower Socio-economic Status: Results from a Linked Dataset

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ABSTRACT

Objective: The purpose of this paper was to use a linked dataset to compare health care utilization rates and costs between income groups in Saskatoon, Canada.

Methods: The Canadian Community Health Survey was linked to hospital, physician and medication data in Saskatoon.

Results: Of 3,688 eligible participants, 3,433 agreed to the health survey and data linkage with health records (83.7% overall response). Low-income residents were 27-33% more likely to be hospitalized and 36-45% more likely to receive a medication than middle- and higher-income residents, but were 5-7% less likely to visit a physician over a one-year period. In comparison to middle-income residents, low-income residents had 56% more high users of hospitals, 166% more high users of physicians and 90% more high users of medications. Low-income residents had 34-35% higher health care costs overall than middle- and high-income residents. After multivariate adjustment for increased disease prevalence, low income had a reduced association with high health care utilization.

Conclusions: The results demonstrate that residents with lower income are responsible for disproportionate usage of hospitals, physicians and medications; due mainly (but not entirely) to higher disease prevalence.

Key words: Delivery of health care; utilization; socioeconomic factors; economics

La traduction du résumé se trouve à la fin de l'article.   *Can J Public Health* 2009;100(3):180-83.

P ersistent socio-economic inequalities are a costly economic deadweight in terms of higher expenditures on health care, income assistance, social services, correctional services and lost tax revenue.[1] Two reports from Canada and the European Union have concluded that disparities in socio-economic status account for 20% of total health care resources.[2,3] The concern, however, with using estimates of self-report health care utilization through telephone surveys is that the recall of 'number of contacts' with health care services does not demonstrate good validity.[4]

The primary purpose of this paper was to use a linked dataset to compare actual health care utilization rates, high health care utilization patterns and overall costs between income groups in Saskatoon, Canada. The second purpose was to use regression analysis to determine which covariates were independently associated with high health care utilization after controlling for disease prevalence.

METHODS

The Canadian Community Health Survey (CCHS) is administered by Statistics Canada with the central objective of collecting self-report health-related data at the level of health regions.[5] The CCHS consists of cross-sectional surveys in 2000/01, 2003 and 2005. The methodology of the CCHS has been documented in detail previously.[5]

Income status was based on the Low Income Cut-Off (LICO) developed by Statistics Canada.[6] Cut-off points are adjusted for family size, population of area of residence, urban/rural differences and consumer price index. For example, a single adult in Saskatoon with an income less than $18,000, and a family of four with an income of less than $33,000, fall below the LICO and are therefore classified as low-income earners. High-income earners were those who made more than $80,000 per year. The remainder were classified as middle-income earners.

The review of health care utilization included hospitals (including emergency room and day surgeries), physicians (including specialists) and prescription medications. Saskatchewan has universal health coverage for all residents, with a centralized administrative database that collects information on all hospital separations, physician visits and medication usage. The positive predictive value of a primary diagnosis from hospital administrative data in Saskatchewan (for stroke) is 90%.[7] At the time of the CCHS survey, each respondent was asked to consent to having their self-report survey information linked with their provincial health records. The respondents' name and Saskatchewan Health Services number were collected at the time of interview. Saskatchewan Health completed the data linkage and provided the de-identified dataset to the researchers. The overall counts of utilization were collected for the year in which the survey was completed (i.e., health care utilization for 2005 if CCHS survey was completed in 2005) and then merged into one larger sample in order to increase precision of the estimates.

Table 1. Overall Health Care Utilization in One Year – Including Rates of High Utilization

Health Care Utilization in One Year	Low Income (n) (%)	Middle Income (n) (%)	High Income (n) (%)	Low vs. Middle Income RR (95% CI)	Low vs. High Income RR (95% CI)
# of people who attended hospital	387 (49.2)	692 (38.5)	315 (36.8)	1.27 (1.16-1.25)	1.33 (1.19-1.49)
# of people who visited MD	618 (78.7)	1517 (84.6)	707 (82.6)	0.93 (0.89-0.97)	0.95 (0.91-1.01)
# of people who received RX	415 (52.8)	696 (38.8)	310 (36.2)	1.36 (1.25-1.49)	1.45 (1.30-1.62)
High health care utilization in one year*	**Low Income (n) (%)**	**Middle Income (n) (%)**	**High Income (n) (%)**	**Low vs. Middle Income RR (95% CI)**	**Low vs. High Income RR (95% CI)**
# of people who attended hospital	92 (23.8)	105 (15.2)	58 (18.5)	1.56 (1.21-2.00)	1.28 (0.96-1.72)
# of people who visited MD	169 (27.4)	298 (10.3)	126 (8.4)	2.66 (2.26-3.13)	3.26 (2.66-4.00)
# of people who received RX	123 (29.7)	108 (15.6)	57 (17.1)	1.90 (1.51-2.39)	1.73 (1.31-2.28)

Total Sample size (N): 3433
Sample by Income status (n): Low Income = 785; Middle Income = 1793; High Income = 855
* > 80th percentile for the overall group

Table 2. Total Costs of Health Care Utilization by Income Group

	Mean Costs for Low-income Users of Health Care*	Mean Costs for All Low-income People†	Mean Costs for Middle-income Users of Health Care*	Mean Costs for All Middle-income People†	Mean Costs for High-income Users of Health Care*	Mean Costs for All High-income People†
Hospital	$1,208.22	$594.40	$929.98	$358.00	$973.11	$358.10
MD	$2,852.24	$2,244.70	$2,016.07	$1,705.60	$2,013.59	$1,163.20
RX	$3,125.43	$1,650.20	$2,319.92	$900.10	$2,491.16	$901.80
Total Cost	$7,185.89	$4,489.30	$5,265.97	$2,963.70	$5,477.86	$2,923.10

* Average cost per user of health care per income group
† Average cost per person (regardless of actual utilization) per income group

Hospital costs based on ICD-10 separation codes were calculated by Strategic Health Information Planning Services and Finance of the Saskatoon Health Region. The costs provided were direct departmental costs and do not include overhead (i.e., administration) or support costs (i.e., lab or medical imaging). The cost of physician visits was provided by Saskatchewan Health. For medications, the average cost per drug within each class was calculated using the Saskatchewan Drug Formulary.

The first comparison was one-year incidence counts of health care utilization for hospitals, physicians and medications by income group. The second comparison was to review high health care utilization of hospitals, physicians and medications by income group by calculating the upper 20th percentile of utilization overall. Once determined, each income group was reviewed independently to determine what percentage of users fell above or below the upper 20th percentile of overall users of hospitals, physicians and medications. The third comparison was the cost of hospitals, physicians and medications by income group in order to determine mean cost per user of hospitals, physicians or medications.

Three separate binary logistic regression models were built to describe the relationship between the outcome variables of a) high utilization of hospitals, physicians or medications (upper 20th percentile) in comparison to b) lower 80th percentile usage of health care. The covariates within the regression models included the demographics of age (12-39, 40-59 and 60 and above), gender and cultural status (Caucasian and Aboriginal). Health outcomes included self-report health (good/fair/poor compared to excellent/very good) and self-report heart disease prevalence, diabetes prevalence and lifetime suicide ideation. Socio-economic status included family income (described above) and individual education (less than high school grad, high school grad and university education). Disease intermediaries included blood pressure (yes/no) and body mass index (obese/overweight versus normal/underweight). Behaviours included physical activity (regular/occasional/infrequent), smoking (daily versus other), alcohol usage (5 or more drinks at a time at least once per week or not in the past year) and consumption of fruits and vegetables (5 servings per day or not). Life stress was measured by current amount of stress in daily life.

A hierarchal well-formulated step-wise modeling approach was used instead of a computer-generated stepwise algorithm.[8] In the final model, the unadjusted effect of each covariate was determined and then entered one step at a time based on changes in the –2 log likelihood and the Wald test.[9]

Ethics approval was obtained from the University of Saskatchewan Behavioural Research Ethics Board.

Table 3a. Prevalence of Self-report Health Outcomes by Income Group

Disease Outcome	Low Income n (%)	High Income n (%)	P-Value
Has high blood pressure	163 (20.8)	115 (13.5)	0.000
Has heart disease	75 (9.6)	32 (3.7)	0.000
Has diabetes	59 (7.5)	37 (4.3)	0.018

Table 3b. Stratified Analysis for High Hospital, Physician and Medication Use by Disease Outcome and Income Group

Variable	High Users + Low Income %	High Users + High Income %	P - Value
Hospital use			
Has high blood pressure	22.1	20.0	0.000
Does not have high blood pressure	8.8	4.7	
Has heart disease	28.0	34.4	0.000
Does not have heart disease	9.9	5.7	
Has diabetes	25.4	16.2	0.002
Does not have diabetes	10.5	6.2	
Physician use			
Has high blood pressure	43.5	37.1	0.000
Does not have high blood pressure	23.4	13.0	
Has heart disease	57.1	48.3	0.000
Does not have heart disease	24.5	15.1	
Has diabetes	44.6	45.7	0.003
Does not have diabetes	26.2	14.9	
Medication use			
Has high blood pressure	43.5	37.1	0.000
Does not have high blood pressure	23.4	13.0	
Has heart disease	57.1	48.3	0.000
Does not have heart disease	24.5	15.1	
Has diabetes	44.6	45.7	0.003
Does not have diabetes	26.2	14.9	

Table 4. Crude and Adjusted Estimates for High Utilization of Hospitals, Physicians and Medications

Variables	Crude OR	Adjusted OR	95% CI	P - Value
A. Covariates of high hospital use				
Has high blood pressure	3.79	1.20	0.79-1.81	0.377
Has diabetes	2.77	1.20	0.69-2.09	0.514
Has heart disease	6.38	1.66	1.02-2.72	0.041
Good/fair/poor self-report health	4.08	2.60	1.68-4.04	0.000
Age 60 and above	10.94	7.81	4.31-14.17	0.000
Age 40-59	2.40	2.98	1.59-5.58	0.001
Low personal income	1.80	1.07	0.73-1.56	0.726
B. Covariates of high physician use				
Has high blood pressure	3.19	1.37	0.97-1.91	0.066
Has diabetes	3.27	1.44	0.90-2.30	0.127
Has heart disease	6.23	1.95	1.24-3.07	0.004
Good/fair/poor self-report health	3.04	2.14	1.60-2.86	0.000
Age 60 and above	5.50	3.29	2.27-4.77	0.000
Age 40-59	1.90	2.15	1.50-3.09	0.000
Low personal income	1.96	1.36	1.03-1.80	0.027
C. Covariates of high medication use				
Has high blood pressure	6.18	2.87	1.90-4.35	0.000
Has diabetes	6.40	4.27	2.46-7.41	0.000
Has heart disease	5.04	2.73	1.63-4.58	0.000
Good/fair/poor self-report health	3.52	2.59	1.61-4.17	0.000
Age 60 and above	14.23	5.04	2.15-11.80	0.000
Age 40-59	4.39	2.67	1.10-6.44	0.029
Low personal income	1.87	1.29	0.85-1.99	0.235

Reference categories for independent variables – Blood pressure – No; Diabetes – No; Heart disease – No; Self-report health – Excellent/very good; Age – 12-39 Yrs; Income – ≥80,000
A. High hospital use: R^2 = .217; Goodness-of-fit = .234 B. High physician use: R^2 = .297; Goodness-of-fit = .438; C. High medication use: R^2 = .365; Goodness-of-fit = .640

RESULTS

Over three cycles in 2001, 2003 and 2005, 4,103 residents of SHR were asked to complete the CCHS with 3,867 agreeing to participate (94.2%) and complete data available on 3,688 participants (89.9%). Of these 3,688 participants, 3,433 agreed to the data linkage with health records (83.7% overall). By individual cycle, the sample sizes were 1,174, 1,082 and 1,177. With all three cycles merged, the mean age was 46.3 (SD 20.32), females represented 55.2% of the sample and Caucasians represented 73.4% of the sample. In comparison to 2001 census data for SHR, the sample had a statistically significant difference in age (p=0.01) but not gender or cultural status. Based on the definitions of income discussed above, there were 785 low-income, 1,793 middle-income and 855 high-income participants; which is also consistent with the 2001 census.

At the cross-tabulation level, low-income residents were 27-33% more likely to be hospitalized and 36-45% more likely to receive a medication but were 5-7% less likely to visit a physician over a one-year period in comparison to middle- and high-income earners (Table 1).

The upper 20th percentile for health care utilization over one year was determined to be greater than 2 hospital visits, 32 physician visits and 29 medications. In comparison to middle-income residents, low-income residents had 56% more high users of hospitals, 166% more high users of physicians and 90% more high users of medications. In comparison to high-income residents, low-income residents had 28% more high users of hospitals, 226% more high users of physicians and 73% more high users of medications (Table 1).

The average cost of hospitals, physicians and medications over a one-year period for low-income residents who accessed health care was $7186. The average costs for middle- and high-income residents who accessed health care were $5266 and $5478. Low-income residents who used health care had 24-27% higher costs in comparison to middle- and high-income residents (Table 2). If we calculate health care costs for all low-income residents combined (regardless of access to health care), the average cost for all low-income residents is $4489 in comparison to $2964 and $2923 for all middle- and high-income residents; which equates to 34-35% higher health care costs overall.

After cross-tabulation, it was found that low-income residents have higher prevalence rates of high blood pressure, heart disease and diabetes (Table 3a). After stratification, those with higher disease prevalence were more likely to have higher health care utilization. However, in most cases, low-income residents were still more likely to have high health care utilization even after controlling for disease prevalence (Table 3b).

After multivariate logistic regression, high hospital utilization was independently associated with the covariates of heart disease prevalence, lower self-report health and higher age. High physician utilization was independently associated with the covariates of heart disease prevalence, lower self-report health, higher age and low income. High medication utilization was independently associated with the covariates of high blood pressure, diabetes, heart disease, lower self-report health and higher age. The results are presented in Table 4.

DISCUSSION

In 2005, Saskatchewan residents paid $528,759,380 for physician services, $1,875,752,000 for health regions to provide mainly hospital services and $184,020,000 for prescription medications for a sum of $2,588,531,380 out of a total health care budget of $2,990,625,000 for a population of 1,020,966.[10,11] In other words, every Saskatchewan resident consumed an average of $2929 health care costs in 2005. This is very similar to the $2964 average health care costs for all middle-income earners and $2923 average health care costs for all high-income earners calculated in this study.

According to the 2001 Canadian census, low-income earners in Saskatoon represented 17.1% of the entire population and, as such, should consume $511,396,875 of health care costs.[12] However, this study demonstrates that low-income residents consume 35% more costs overall than anticipated in comparison to middle- and high-income residents. In other words, low-income residents in Saskatchewan consume an extra $178,988,906 in health care costs than if they were middle income.

The cross-tabulation finding that on average low-income residents access physicians less often, and hospitals more often, in comparison to other income groups has been demonstrated previously.[2,13] Low-income groups have more complex needs while at the same time have less continuous and comprehensive health care; which results in more usage of expensive services like hospitals.[3] In fact, the highest-income groups are the most likely to receive optimal primary care and obtain more referrals to specialists, which widens health disparities.[2]

In our study, low-income status was also associated with high health care utilization (upper 20th percentile) of hospitals, physicians and medications at the cross-tabulation level. However, after multivariate adjustment, low-income status had a reduced association with high health care utilization after controlling for disease prevalence. After controlling for the prevalence of high blood pressure, heart disease, diabetes, low self-report health and age, the odds of high health care utilization dropped for low-income residents by 73% for hospitals, 60% for physicians and 58% for medications. The results suggest that most (but not all) of the disparity in high health care utilization for lower-income residents is associated with higher disease prevalence, and not merely a difference in utilization behaviour. This finding is consistent with the literature.[14,15] In these studies, the increased use of family physician and hospital services in lower socio-economic groups corresponded to higher needs resulting from poor health.[14,15]

The finding that high health care utilization is associated with higher age and lower self-report health is supported by a linked study from Nova Scotia.[16] Another linked study from Manitoba found high-cost users of medications were more likely to be low income, older in age and more likely to have a chronic condition; all of which are consistent with our results.[17]

The dataset is believed to be valid. First, the overall participation rate and consent to the data linkage was 83.7% in the sample with only a slight bias in age. Second, the utilization rates are believed to be accurate. For example, 84.6% of middle-income respondents within the sample visited a physician within one year while the annual statistical report for 2005 states that 83.6% of the Saskatchewan population accessed a physician within that year.[10] Third, the health care cost information from the sample is very similar to the costs from the annual statistical report presented above.

The limitation of the study is that it is cross-sectional, and not prospective, and as such cause and effect cannot be determined.

The Health Disparity Task Groups of the Federal/Provincial Advisory Committee on Population Health and Health Security concluded that the most appropriate and effective way to improve overall population health status in Canada is to improve the health of those in lower socio-economic groups.[2] The results from this study demonstrate that residents from lower socio-economic status are responsible for disproportionate usage of hospitals, physicians and medications; due mainly to differences in disease prevalence.

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RÉSUMÉ

Objectif : Utiliser un ensemble de données interreliées pour comparer les taux et les coûts d'utilisation des soins de santé entre différentes catégories de revenu à Saskatoon, Canada.

Méthodes : Les données de l'Enquête sur la santé dans les collectivités canadiennes ont été reliées à celles de la base de données sur les hôpitaux, les médecins et les médicaments de Saskatoon.

Résultats : Des 3 688 participants admissibles, 3 433 ont accepté qu'un lien soit créé entre les données de l'Enquête et celles de leur dossier médical (taux de réponse de 83,7 %). Les résidents à faible revenu ont de 27 à 33 % plus de chances d'être hospitalisés et de 36 à 45 % plus de chances de recevoir un médicament que les résidents à revenu moyen et élevé, mais de 5 à 7 % moins de chances de consulter un médecin une fois par année. Comparativement aux résidents à revenu moyen, les résidents à faible revenu comptent 56 % plus d'utilisateurs d'hôpitaux, 166 % plus d'utilisateurs de services médicaux (médecins), et 90 % plus d'utilisateurs de médicaments. Chez les résidents à faible revenu, les coûts des soins de santé étaient de 34 à 35 % plus élevés que chez les résidents à revenu moyen et élevé. Après avoir effectué les corrections multidimensionnelles de l'augmentation du taux de prévalence de maladie, les résidents à faible revenu démontrent une association réduite avec l'utilisation fréquente des soins de santé.

Conclusions : Les résultats démontrent que les résidents à faible revenu utilisent de façon disproportionnée les hôpitaux, les médecins et les médicaments, et ce, principalement (mais non entièrement) en raison d'un taux plus élevé de prévalence de maladie.

Mots clés : prestation de soins de santé; utilisation; facteurs socioéconomiques; économie