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Equity and Health Care: Analysis of the Relationship Between Need for Care and the Utilization of Nursing Services in Canada

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Cet article se fonde sur les données de l'Enquête sociale Canada (1985) pour examiner les relations entre les besoins en soins de santé et l'utilisation des soins infirmiers. Il passe d'abord en revue les études sur le lien entre l'utilisation et les besoins, puis il établie les hypothèses et les méthodes de l'étude et présente les variables sélectionnées aux fins de l'analyse. L'incidence de l'utilisation des soins infirmiers est estimée en utilisant la ligne de régression des probits. La quantité d'utilisation est estimée avec le modèle correctif: self-selectivity. Les analyses subséquentes explorent les relations utilisation-besoins en découpant l'échantillonnage par niveau de besoin et en examinant les effets de l'interaction. Les résultats indiquent que la probabilité la plus faible d'utilisation des soins infirmiers est associée aux niveaux de besoin les plus faibles, au sexe masculin, aux personnes mariées et aux niveaux d'éducation les plus faibles. Le besoin est également associé de manière significative au nombre de contact avec les soins infirmiers. Le revenu n'est pas une variable significative, mais le niveau d'importance de la relation utilisation-besoins est influencé par des variable socio-économiques et démographiques, suggérant ainsi la nécessité d'analyses désagrégées.

This paper examined the relationships between need for care and the utilization of nursing services using data from the 1985 Canada Social Survey. The incidence of nursing utilization was estimated using probit regression, and the quantity of utilization, using a self-selectivity model. Further analyses involved exploring use-need relationships by partitioning the sample by need level and by examining interaction effects. It was found that a lower likelihood of using nursing services was associated with lower levels of need, males, married persons, and lower levels of education. Need was also significantly associated with the number of contacts with nurses. While income was not significant, the size of the use-need relationship was affected by socioeconomic and demographic variables, pointing up the necessity of disaggregated analyses.

Since the introduction of the Hospital Insurance and Diagnostic Services and Medical Acts and their consolidation through the passing of the 1984 Canada Health Act, much attention has been focused on whether Canadian citizens enjoy "reasonable access" to insured health-care services. The stated objective of the legislation was to protect, promote, and restore the physical and mental well-being of Canadians and to facilitate reasonable access to health services

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without financial or other barriers. No definitions of "reasonable" or "access" were provided, and research has focused on the relationships between the price of care, levels of income or wealth, and levels of utilization. If financial barriers do not exist in terms of observed differences in utilization across income groups then reasonable access is achieved. Such research (e.g., Barer, Manga, Shillington & Segal 1982; Boulet & Henderson, 1979) interprets reasonable access as equal use of services across populations heterogeneous in ability to pay irrespective of their need. However, little attention has been given to the role of needs for health care in explaining variations in the use of health-care services. As Manga (1987, p. 640) noted, "If there is in fact a negative relationship between the need for medical care and income class...then a situation in which there is no statistical difference in the utilization of medical care by income class may still be inequitable."

Literature Review

Considerable efforts have been made in the literature to model utilization behaviour in ways which explicitly recognize the influence of need (Aday & Anderson, 1974; Anderson, 1968; Anderson & Newman, 1973; Becker, 1974; Joseph & Phillips, 1984; Rosenstock, 1966). Anderson (1968) proposed a model of utilization in which the explanatory variables were categorized as follows: variables that predispose towards utilization (e.g., family composition, social structure), those that enable utilization (e.g., income, insurance status); or need factors which generate the purpose of utilization. The same categorization was used by Andersen and Newman (1973) and Aday and Andersen (1974), but in the broader context of existing health-care systems. However, even if the factors in this model predict utilization, the organization and structure of the health-care system may inhibit or prevent it. Accessibility, in terms of whether persons in need of care receive it, has a separate influence on utilization.

Although the Aday and Andersen model has formed the basis for much of the empirical literature on health-care utilization over the last 15 years, several authors have questioned its conceptual basis (Arling, 1985; Mechanic, 1979; Rundall, 1981; Wolinsky, Coe, Miller, Prendegast, Creel & Chavez 1983; Wolinsky & Coe, 1984). Rundall (1981) suggested that the additive forms of the empirical models employed in the research fail to capture the conditional elements of the underlying conceptual model. Similarly Arling (1985, p. 370) argued that "...the distinctions that have been drawn between need, enabling, and predisposing conditions have heuristic value but may obfuscate the causal relationships in the model. The hierarchial, additive approach of regressing health service use on these broad categories of predictor variables tends to obscure the mediating effects of factors such as psychologic distress, activities of daily living, impairment, social support and economic status."

Some studies of health-care utilization in Canadian populations have introduced indicators of, or proxies for, need as an explanatory variable (Broyles, Manga, Binder, Angus & Charette, 1983; Enterline, Salter, & McDonald, 1973; Manga, Broyles & Angus, 1987; Roos & Shapiro, 1981). For example, Broyles et al. (1983) and Manga et al. (1987) used multiple regression analysis and a simple additive model to estimate the relative importance of need in explaining variations in health-care use. A major limitation of this work is that the need variables available to the authors tended to be either directly or indirectly related to health care utilization (e.g. previous use of prescribed medicines) and hence did not represent the independent effect of need on use (see Birch & Eyles 1992). Moreover, in the empirical model used by the authors any influences that need, income or any other explanatory variable might have on use is assumed to be independent of other influences. In addition, there is a potential for biased estimates in their analyses because they fail to recognize that users of care are a self-selected group from within the population sample of users and non-users, and this violates the normality condition of the multiple regression technique used.

Several non-Canadian studies have gone beyond looking at the relative importance of different explanatory variables and considered the relationships between use and need more directly (Blaxter, 1976; Blendon et al., 1989; Forster, 1976, 1977, 1979; Greenberg et al., 1988; Hayward, Shapiro, Freeman & Corey 1988; Le Grand, 1978; Newachek, 1988; Wenneker & Epstein, 1989). These studies point to significant variations in the relationship between use and need across population groups differing in some other explanatory variable (e.g., income). However, both Collins and Klein (1980) and O'Donnell and Propper (1991) showed that analyzing variations in use across groups heterogeneous in needs produced biased estimates of use-need relationships if utilization occurred among those reporting no needs. It is therefore important to look beyond comparisons of simple use-need ratios in order to address the question of reasonable access and analyze the interaction of need with other explanatory variables (e.g., identify factors which explain variations in use of services among populations with similar levels of need).

Ronis and Harrison (1988) evaluated the use of interaction terms in studies of physician use, and showed that their inclusion is unlikely to lead to large increases in explanatory power, particularly if there is substantial measurement error in predictor variables. Furthermore, the use of interaction terms increases significance occurring by chance alone (i.e., inflates the alpha level), reduces the degrees of freedom leading to restrictions in the sensitivity of significance tests, and can be confounded with non-linear effects. Nevertheless, they argued that these concerns should not discourage analysts from including interaction terms where a priori reasons exist for such effects since they can help in understanding relationships. In other words interaction

terms should be used sparingly and carefully and not without an underlying rationale. Significant effects have been found where interactions between explanatory variables were included in utilization models (Arling, 1985; Puffer, 1987; Sharp, Ross & Cockerham 1983; Winter 1987). In particular, both Puffer (1987) and Winter (1987) found that specific interactions between need and socioeconomic status were significant in explaining observed variations in use and improved the overall performance of their model.

Purpose

The purpose of this paper was to explore the relationship between use and need in the context of nursing services in Canada. The authors used analytical methods that reflect the selectivity of users of care and the conditional nature of utilization while employing indicators of need that are less confounded by prior use of health-care services. Existing research on the utilization of nursing services has been concerned largely with evaluating the use of nursing as a substitute for other health care inputs (e.g., Bishop, 1988; Carnevali & Little, 1976; Prescott, Janken, Langford & McKay 1983; Shukla, 1983; Williams & Fitton, 1991). It may be that there has been little research focused on nursing services in Canada because they are not an insured service in the Canada Health Act, and hence reasonable access to them is not a policy goal. The Federal government states that the principle of reasonable access should be applied to "necessary hospital and physician services" (Health and Welfare Canada, 1989). Nevertheless, given that nursing is the largest health-care profession in Canada (Taylor, 1986), with 134 people per active nurse compared to 506 per active physician (Health and Welfare Canada, 1985), it seems appropriate to consider whether the deployment of nursing services is in line with needs for services, especially given the apparent invisibility of nursing care (Lawler, 1991). One question of interest is whether the population distribution of utilization of nurses corresponds to the distribution of relative levels of need for health care.

Method

The first stage of the analysis considered the importance of variations in need (as proxied by self-assessed health status) in explaining the distribution of the incidence and quantity of service utilization. The second stage of the analysis considered which factors were associated with variations in the use of nursing services in relation to need for care. Thus, the following null hypotheses were tested:

1. In a fixed time period the probability and level of utilization of nursing services are independent of need.
2. The relationship between level of utilization of nursing services and need for services is independent of income, education, province or region of residence, and social support.

The data used for testing the hypotheses were from the 1985 General Social Survey (GSS) (Statistics Canada, 1987). This national survey of the non-institutionalized population age 15 years or older collected data on individuals' reported health-care utilization, their self-assessed health status and well-being, various sociodemographic and socioeconomic variables, and other behavioural characteristics. Data had been collected by personal interview of persons in the sample aged 65 and over, and telephone interview of those 15 to 65 years old. A random sample size of about 13,000 (approximately one per 2,000 population) was obtained through the survey. The overall response rate was 84.2 percent. The main exclusions from the sample were the Yukon and North West Territories (both samples) and persons living on Indian Reserves (the elderly sample). The elderly sample was based on households previously surveyed for the Labour Force Survey. The non-elderly sample was allocated between provinces on the basis of the square root of the provincial populations. For the estimated variances of variables to be meaningful, weighting of the sample data was required to allow for the differential probability of inclusion in the sample. Weighting was performed using the weights developed by Statistics Canada for use in analyzing the GSS data set (Statistics Canada 1987).

It should be noted that the data on both use and need are based on self-reports and depend upon the recall and awareness of respondents. Nevertheless, there is substantial empirical support for the validity of self-assessments of health as measures of health status (Davies & Ware, 1981; Kaplan & Camacho, 1983). Self-assessed health has been observed to perform better as a predictor of future mortality than other more conventional measures of health status (Idler, Kasl & Lemke 1990; Mossey & Shapiro, 1982). This suggests that self-assessments are probably as good a proxy for health care needs at the population level as alternative indicators. Moreover, unlike most other large population surveys, the GSS provides information on needs independent of service use. Consequently, it was one of the few data sources available to address our research questions.

The variables selected for use included: the use category of nurse contacts (number of times); the need category of general health; the predisposing category which contained sex, age, marital status, region of residence, employment status, activity level, degree of community contact, smoking, drinking, and life satisfaction; and the enabling category which included household income, level of education, and household tenure. The nursing utilization variable was based on response to the question: "During the last 12 months, how many times did you see or talk to a nurse?" With the exception of income, all of the explanatory variables were categorical.

Four proxy variables for need were selected from the source data set; all were independent of current utilization. These were: individuals' assessment of their general level of health, satisfaction with their own health defined over four categories, the presence or absence of long-standing limiting illness, and the number of days in the previous two weeks that individuals' activities were limited by their health. Other health status variables available in the data set were not included because they were defined in part by health-care use (e.g., since the number of days confined to bed with illness included hospital days, it was not independent of the measure of hospital utilization). Correlation coefficients among the four selected proxies ranged from 0.24 (between days of activity limitation and the incidence of long-standing limiting illness) to 0.56 (between health satisfaction and general health), indicating a considerable level of intercorrelation.

The general health measure was selected as the preferred indicator of need for two main reasons: there is considerable support in the health-services research literature for its validity as a measure of health (Davies & Ware, 1981) while the validity of the other measures is less well established; and the distribution of the responses for this variable was less skewed than with the other three proxies for need. Neither the estimated relationships between use and need nor the estimated coefficients for the other explanatory variables changed noticeably when equations were estimated using each of the four proxies separately. Similarly, the overall significance and explanatory power of the equations was not affected in any significant way.

The first null hypothesis was tested using two approaches. First, the incidence of nurse utilization was estimated using probit regression, since the dependent variable (use or no-use) is dichotomous and assumed to be a non-linear function. The advantage of the probit model over ordinary least squares regression (OLS) is that it constrains the probability of contact (or use) to lie between 0 and 1. The probit model was defined by:

$$P_u = F(\alpha + \beta X_i)$$

where P_u is the probability of the event occurring, F is the cumulative probability function, X_i is a vector of independent variables, α is a constant, and β is a vector of estimated coefficients. Since the function is non-linear, a maximum likelihood procedure was used to estimate the coefficients. Bivariate or multivariate representations were created because most of the variables included within the model were categorical. One value of each variable was selected as the reference value, and a series of dummy variables created. For example, the reference category for general health (the need proxy) was *poor health* and dummy variables were created for the levels of *excellent, good,* and *fair health.* Following Aday and Andersen (1974), explanatory variables were entered in blocks into an equation for use of services according to the *need,*

predisposing or *enabling* categorization. Variables were entered additively and forced into the equation based on a priori expectations concerning the relationship between use and the explanatory variable. Only 'activity level' and 'housing tenure', if significant, were allowed to enter the model, since no a priori expectations were held.

As in OLS, the t-test determines whether a particular parameter differs from zero. Goodness-of-fit of the model is evaluated by the likelihood ratio test (LR) and rho-squared. The LR, similar to the F-test in OLS, measures the overall significance of the model. Rho-squared fulfills much the same role as R-squared in OLS in that higher values indicated greater explanatory power, but unlike R-squared, it is not a measure of the percentage variation explained by the model.

The second stage of the analysis focused upon the quantity of nurse use recorded by the subset of the sample population who had had at least one nurse contact over the previous year. Since counts of events must be non-negative integers, a discrete distribution such as the Poisson distribution provides a more appropriate basis for analysis of these data than the normal distribution underlying OLS regression (Flowerdew & Lovett, 1988). However, the observed value of the dependent variable is a count of independent events generated by a Poisson distribution. Hence, where the occurrence of one event increases the probability of others, as might be the case in healthcare utilization where the number of events is not necessarily independent of supply factors, the use of Poisson regression is not appropriate.

In situations where the independence assumption is violated, the negative binomial model provides a close approximation to the Poisson model (Johnson & Kotz, 1969). However, use of the negative binomial model does not allow for self-selectivity bias within the sample. Because users of nursing services may be self-selected (i.e. differ systematically from the rest of the sample in ways not known to the researcher), any estimates of the relationship relying upon traditional OLS estimation techniques may be biased and lead to false inferences about causality. In this situation, the quantity of use equation (represented by the total number of nursing contacts) was estimated using a self-selectivity model, and quantity of use estimated using a two-stage estimation technique following Heckman (1979) and Maddala (1983). A correction factor (lambda) was estimated using probit analysis on the full sample and then entered into a least-squares regression of number of nurse contacts on *need, predisposing* and *enabling* variables. The statistical significance of the lambda variable was an indicator of whether the correction was statistically important.

The second null hypothesis was to be tested in two ways. First, the sample was partitioned by level of need and the two-stage estimation procedure applied to each level. If the explanatory variables were significant in explaining variations within groups homogeneous in need, this indicated that factors other than need were associated with the distribution of utilization amongst the population (i.e. horizontal inequity). On partitioning, sample size problems prevented the use of this analysis for nursing services, although it was successfully completed elsewhere for physician services (Birch, Eyles & Newbold 1993) and hospital utilization (Newbold, Eyles & Birch 1993). Secondly, to further explore this relationship and use the variation in the need variable as part of the analysis in particular, the model was re-estimated for the full subsample of users with interaction terms between need and specific explanatory variables based upon the findings of the disaggregate analysis.

Results

Incidence of nursing service utilization

The estimated coefficients (B) and 95 percent confidence intervals (CI) for the probit regressions of use – no use of nurses on the explanatory variables are shown in Table 1. The equation was significant ($p < 0.05$ one-tailed test) with a rho-squared of 0.046. This value, although low, is not atypical for studies of this type (see McFadden 1974). However, lower levels of need were associated with a significantly lower likelihood of having used the service ($p<0.05$ two-tailed test). As would be expected, the likelihood of use increased with increasing need. However, predisposing variables (age, sex, marital status, region, etc.) contributed the greatest proportion of the explained variation.

Men were significantly less likely to have used nursing services than women. Although the difference is not significant, the likelihood of use was greater among those aged 15 to 19 and 20 to 24 years old than among those aged 75 and over. The incidence of use of nurse services was significantly lower among the employed. However, this probably reflects a correlation between employment status and health (the "healthy worker" effect), particularly since the employment categories specified are conditional on health (e.g., permanently unable to work or sick). Household income was positively correlated with the likelihood of having used the service, although the relationship was not significant. There was a trend for higher levels of education to be associated with greater likelihood of having used nurses. This might be because a high proportion of ambulatory nursing tasks are associated with prevention, which less-educated groups may be less likely to have used. Higher levels of community contact were associated with a lower likelihood of having used nursing services, possibly because such individuals consulted friends and/or family before referring themselves to the formal health-care

Table 1

Probit Regression: Incidence of nursing service utilization

Explanatory variables		B	CI
General Health	Excellent	–0.654*	(–0.86,–0.45)
	Good	–0.660*	(–0.86,–0.46)
	Fair	–0.404*	(–0.61,–0.20)
Sex	Male	–0.092*	(–0.18,–0.00)
Age	15–19	0.056	(–0.24,0.35)
	20–24	0.145	(–0.11,0.40)
	25–44	–0.006	(–0.23,0.21)
	45–64	–0.062	(–0.27,0.15)
	65–74	–0.075	(–0.29,0.14)
Marital Status	Married	–0.255*	(–0.43,–0.08)
	Single	–0.113	(–0.32,0.09)
	Widow	–0.082	(–0.32,0.16)
Region	Quebec	–0.227*	(–0.40,–0.05)
	Ontario	0.079	(–0.08,0.24)
	Prairies	–0.049	(–0.23,0.13)
	B.C.	–0.077	(–0.28,0.12)
Employment	Working	–0.201*	(–0.31,–0.09)
	Sick	0.437*	(0.17,0.70)
	Looking	0.106	(–0.09,0.30)
Community Contact	Frequent	–0.350	(–1.08,0.38)
	Infrequent	–0.321	(–1.05,0.41)
Smoking	Daily	–0.113*	(–0.21,–0.02)
	Occasional	0.008	(–0.18,0.19)
Drinking	Daily	–0.064	(–0.10,0.22)
	Occasional	0.80	(–0.01,0.17)
Household income (000s)		0.002	(–0.00,0.01)
Education	No SSGD	–0.126*	(0.25,–0.01)
	SSGD	–0.515*	(–0.64,–0.39)
	Some Post-Secondary	–0.019	(–0.14,0.11)
Constant		0.113	(–0.69,0.91)
LR-Test		212.4*	
Rho-Squared		0.046	
N		6805	
Overall % Correct		89.4	

*p<0.05

Note: B = Beta Coefficient; CI = Confidence Intervals;
SSGD = Secondary School Graduate Diploma

system. Similarly, married people were significantly less likely to have had contact with a nurse than divorced people. Residents of Quebec were significantly less likely to have used nursing services than those in Atlantic Canada. Ontario was the only region with greater likelihood of use than Atlantic Canada, although the difference was not statistically significant. This might be explained by the levels of availability of nurses: Ontario–10.1/1000; Atlantic Canada–8.66/1000; Quebec–8.5/1000 (1985 figures) (Health and Welfare Canada, 1990).

Overall, these results are in keeping with our investigations of physician services and previous research (Broyles et al., 1983; Manga et al., 1987); the former used a different data set and statistical approach. Lower health status was found to be associated with a significantly greater likelihood of having used services, but the latter had no significant relationship or consistent association with income.

Although the nature of many of the variables and the level of aggregation used indicate that the results should be interpreted with caution, they suggest that distribution of the incidence of utilization of nursing services in the population was related to need or indirectly related factors (i.e.,vertical equity in incidence of use). Moreover, the distribution of incidence of use was largely unrelated to factors other than need (i.e., horizontal equity in incidence of use).

Quantity of nursing service utilization

As earlier mentioned, because users were not a random selection of the study sample of users and non-users, the assumptions of OLS regression were violated and a two-stage estimation procedure was required. Failure to recognize this problem of mis-specification arising from selectivity in the subsample of users could lead to biased estimates. In this procedure, the lambda variable was the correction factor estimated in the first stage of the two-stage procedure which was then entered as an explanatory variable in the second stage. A significant coefficient on lambda indicates that selectivity in the sample does occur and affects the estimates in statistically important ways.

The coefficients estimated using the two-stage procedure for the number of nurse contacts in the previous year is shown in Table 2. Because the number of individuals recording some use of nursing services was only 763, the confidence intervals and coefficients are large and estimated relationships are less likely to be statistically significant. Of all of the variables in these equations only the relationship between number of nurse contacts and need is statistically significant. Those in excellent health were estimated to have 12.11 (CI 18.9, 5.82) fewer nurse contacts than those in poor health. Those in good

Table 2

Two-stage estimation: Quantity of nursing utilization

Explanatory variables		B	CI
General Health	Excellent	−12.11	(−18.9,−5.32)
	Good	−10.93*	(−17.59,−4.27)
	Fair	−7.74*	(−13.13,−2.34)
Lambda		11.01*	(1.13,20.90)
R-Squared		0.212	
Adjusted R-Squared		0.181	
F		6.82*	
N		763	

*p<0.05

Note: Only significant results reported. Full tables available from authors on request.

and fair health also use fewer services than those in poor health although the difference is greater with good health than with fair. Notwithstanding the lack of significance with the remaining variables, the signs and relative size of estimated coefficients were consistent. Residents of the Atlantic Provinces were estimated to have more nurse contacts than those of all other regions. The very elderly, divorced individuals, and the unemployed were found to have fewer nurse contacts than their counterparts. Those with some community contact were likely to utilize nursing services more than those without such contact. This may not imply that social support in the community increases the need for nursing services, but rather that the likelihood of use increases when an individual in need has social support. These findings fail to indicate that lower income groups make greater use of nurse services, other things equal.

Interactions among explanatory variables

The assumption of linearity was relaxed in the equation for utilization. The first stage of this part of the analysis was to partition the subsample of users into categories according to need (excellent, good, fair, or poor health status). An equation for use was then estimated for each different need group using the same two-stage procedure. In this way it was possible to treat the four subsamples as distinct populations. By so doing it is possible to explore the extent to which relationships observed at the aggregate level are general to the full sample and identify relationships that exist between use and other variables but are confined to certain subgroups and hence are not identified by analyses of all users. Unfortunately, when the sample reporting nursing

contact in the last year was broken down into subgroups, the cell sizes were too small to perform the analysis. It may be possibile for those who are interested and have access to larger data sets to follow the logic of our approach. Those interested in the kinds of results produced are referred to the authors' previous investigation of physician services (Birch et al., 1993).

The separate analysis of utilization within subgroups is one way of testing for interactions between explanatory variables. In particular, it tests whether there is a conditional relationship between the two variables of interest, i.e., a relationship that is conditional upon a particular level, or range of levels, of need. Although this approach is consistent with the underlying conceptual model, it does not make full use of the data, nor employ the variation in the need variable as part of the analysis. The inclusion of interaction terms between the particular variables of interest and the need variable overcomes this limitation. However, because the need variables (as well as most of the other variables in the analysis) are categorical, only simple orderings can be imposed on them. Although this implies that the magnitudes of the estimated

Table 3

Two-stage estimation: Quantity of use with need-income interaction

Explanatory variables		**B**	**CI**
General Health	Excellent	–7.229*	(–14.20,–0.26)
	Good	–5.238	(–11.29,0.82)
	Fair	–3.345	(–8.66,1.97)
Age	15–19	–4.107	(–8.61,0.48)
	20–24	–3.960*	(–7.68,–0.24)
	25–44	–4.714*	(–8.04,–1.38)
	45–64	–3.325*	(–6.62,–0.03)
	65–74	–3.654*	(–6.92,–0.38)
Household Income (000s)		0.100	(0.001,0.02)
Need-Income Interaction	Exc-Income	–0.089	(–0.20,0.02)
	Good-Income	–0.11*	(–0.22,–0.003)
	Fair-Income	–0.01	(–0.13,–0.10)
Lambda		5.586	(–4.19,15.36)
R-Squared		0.183	
Adjusted R-Squared		6.329*	
F		6.329*	
N		763	
*p<0.05			

Note: Abbreviations as Table 1. Only significant results and interactions reported.

coefficients of the interaction terms are not meaningful (since the numbers on which they are based have ordinal meaning only), a significant increase in the explanatory power of the equation indicates that the interactions are important contributors to explaining variation in utilization.

The interactions between income and levels of need are shown in Table 3. Although the explanatory power of the equation did not increase significantly and lambda was not significant with the addition of need-income interactions, there were some interesting findings. Use was still inversely related to need, but the relationship was statistically significant only for excellent health. Further, for nearly all age categories, the lower number of contacts with younger ages become significant in this analysis. The income-use relationship also becomes statistically significant. When examined as a direct association, higher income is related to greater quantities of use. When, however, the need-income interaction is analyzed, the sign is reversed so that those with lower levels of need have fewer nursing contacts compared with those in poor health, given particular levels of income. Although this is interesting, these findings must be treated cautiously because of the small sample size.

Table 4

Two-stage estimation: Quantity of use with age-sex interactions

Explanatory variables		**B**	**CI**
General Health	Excellent	–11.835*	(–18.54,–5.13)
	Good	–10.660*	(–17.23,–4.09)
	Fair	–7.552*	(–8.66,1.97)
Sex	Male	0.038	(–3.64,3.71)
Age	15–19	–4.405	(–12.00,3.19)
	20–24	–4.214	(–10.64,2.21)
	25–44	–5.584	(–11.44,0.27)
	45–64	–3.853	(–8.85,1.15)
	65–74	–4.131	(–9.17,0.90)
Need-Income Interaction (20–44) female		1.057	(–3.60,5.71)
Lambda		10.541*	(0.65,20.43)
R-Squared		0.212	
Adjusted R-Squared		0.180	
F		6.57*	
N		763	

*p<0.05

Note: Only significant results and interactions reported.

Table 5

Two-stage estimation: Quantity of use with need-education interactions

Explanatory variables		B	CI
General Health	Excellent	–20.389*	(–32.00,–8.77)
	Good	–18.920*	(–29.82,–8.02)
	Fair	–16.727*	(–27.63,–5.83)
Education	No SSGD	–11.246*	(–20.33,–2.17)
	SSGD	–13.927	(–33.87,6.01)
	Some Post.	–12.790	(–28.78,3.20)
Need-Education Interaction	NOSSGD-EX	10.824	(–0.22,21.87)
	SSGD-EX	12.899	(–7.99,33.79)
	SOMEPOST-EX	13.476	(–3.93,30.88)
	NOSSGD-GOOD	10.141*	(0.42,19.87)
	SSGD-GOOD	13.747	(–6.90,34.39)
	SOMEPOST-GOOD	11.402	(–5.18,27.99)
	NOSSGD-FAIR	10.759	(–0.21,21.73)
	SSGD-FAIR	14.117	(–7.54,35.77)
	SOMEPOST-FAIR	15.271	(–3.22,33.76)
Lambda		11.495	(1.32,21.67)
R-Squared		0.230	
Adjusted R-Squared		0.189	
F		5.69*	
N		763	

*p<0.05

Note: Only significant results and interactions reported. Abbreviation as Table 1.

The interactions between age and sex are presented in Table 4. While the coefficient of interaction was positive, it was not significant. The only statistically significant finding concerned use and need. The quantity of use with need-education interaction estimations are shown in Table 5. While the caveat concerning sample sizes still applies, the size of the education effect remains similar among the levels of need. What is of interest is the increase in size of the direct effect (Table 2 compared with Table 5), the increase in explanatory power from the general (adjusted R^2 0.181), to the interaction model (0.189) and the change in sign – the negative direct relationship is consistent, but the interaction estimations show a positive relationship between education and need.

Finally, as it was not possible to estimate the interaction between nursing contact and community contact because of cell size problems, only need-

region interactions are presented in Table 6. There are some differences between this and the general model; notably the significance of the need variables in explaining observed variations in use disappears. With respect to region of residence, all regions showed greater numbers of nursing contacts than Atlantic Canada (and Ontario significantly so). When we examined the need-region interactions, all need groups in all regions showed fewer nursing contacts than individuals in poor health in Atlantic Canada. In this case region may well be acting as a proxy of the health-care delivery system. Compared with Atlantic Canada, Quebec and the Prairies have fewer nurses per 1000 population, B.C. has the same ratio, and Ontario has more. When looked at regionally, the pattern is roughly consistent but complex.

Table 6

Two-stage estimation: Quantity of use with need-region interaction

Explanatory variables		**B**	**CI**
General Health	Excellent	–1.927	(–12.26,84.1)
	Good	0.285	(–9.40,9.97)
	Fair	0.382	(–8.09,8.85)
Region	Quebec	2.786	(–3.09,8.696)
	Ontario	7.978*	(2.50,13.26)
	Prairies	1.103	(–6.46,8.67)
	B.C.	0.737	(–8.07,9.54)
	Quebec-Ex	–3.574	(–10.23,3.08)
	Ontario-Ex	–8.828*	(–15.36,–2.30)
	Prairie-Ex	–1.941	(–10.48,6.60)
	B.C.-Ex	–2.563	(–12.04,6.92)
	Quebec-Good	–5.904	(–12.46,0.65)
	Ontario-Good	–9.806*	(–16.18,–3.44)
	Prairie-Good	–2.941	(–10.68,4.80)
	B.C.-Good	–2.667	(–11.75,6.42)
	Quebec-Fair	–2.467	(–9.30,4.36)
	Ontario-Fair	–8.240*	(–15.08,–1.40)
	Prairie-Fair	–2.115	(–10.53,6.30)
	B.C.-Fair	–4.902	(–14.80,5.00)
Lambda		2.094	(–9.32,13.50)
R-Squared		0.236	
Adjusted R-Squared		0.193	
F		5.45*	
N		763	

*p<0.05

Note: Only significant results and interactions reported.

Discussion

Thus far results have been presented by level of analysis. In this discussion, particular attention will be paid to whether the relationships observed between the dependent and explanatory variables are common to incidence and quantity, or specific to one or the other level. In particular, relationships between one explanatory variable and both incidence and quantity of use of a service might be explained by the particular variable representing aspects of need which are not picked up by the general health measure. However, observed relationships with a particular variable that differ between levels of analysis cannot be explained by differing needs alone. So for example, if lower education was associated with greater needs for care, but in ways which were not identified by the general health assessment, then we would expect to observe a positive coefficient on the education dummy variable in both incidence and use equations. Where this is not the case, we need to look to other explanations, such as education-related barriers to access. However, there are no education-related barriers to the quantity of service received. So once accessed, the system performs as posited by the Canada Health Act.

The relationship between use of nursing services on the one hand and need and other explanatory variables on the other was largely consistent for both incidence and quantity of use. Lower levels of need, males, married persons, and lower levels of education were all associated with lower likelihood of having used nurses and less frequent use, although only need was significant for both incidence and quantity of use. Some inconsistencies were observed for region and community contact, although none of these relationships were significant. Residents of Ontario were found to be more likely to have used nurses, but had fewer contacts than residents of the Atlantic provinces. Given the relatively large supply of nurses in Ontario this might be explained by the presence of barriers to establishing initial contacts, such as might arise from inappropriate referral systems or uneven distributions of nurses. Similarly, those with greater levels of community contact were observed to be less likely to have used nurses, but to have used nurses more frequently than those with less community contact.

We would have liked to include a measure of ethnicity as an explanatory variable in this study, but data set provided this information only in the form of mother tongue: English, French and Other. As we would expect, there was a strong correlation between this variable and the region variable, which would affect the estimation of coefficients. Moreover, because the Other group was too small, only analysis of anglophone-francophone ethnic issues would be possible. Ethnicity was therefore excluded from the analysis. However, any significant findings concerning differences in utilization rela-

tive to needs between regions (particularly between Quebec and the other regions) might be the result of, inter alia, ethnic differences.

While it was not possible to partition the sample by need subgroup, interaction modelling did alter the picture, especially with respect to income, region, and education. Income and region became important (often significant) with respect to need, mainly in line with expectations. The findings for education were more complex. In any event, the utilization of nursing services in Canada requires further investigation with respect to these variables.

It is important to note that, in the main, the incidence and level of utilization of nursing services was related positively to the level of need for those services as proxied by individual's self-assessments of health status. Further, the incidence and level of utilization were largely independent of household income. While the relationship between use of services and need was independent of income, systematic and in some cases significant relationships were observed between the size of the use-need relationship and particular socioeconomic and sociodemographic variables. Thus, our disaggregated analysis, although made exploratory by the survey question and sample size, suggests that analysis of utilization at the aggregate level of population can conceal important and policy-relevant relationships while revealing others that are essentially artifacts of inappropriate aggregation. In particular, populations of users of care represent neither a random selection of the total population, nor a homogeneous group of service users. The use of interactions between need and other variables to explain variations in utilization indicates that users of care were a mixture of essentially heterogeneous groups. Within these groups utilization appeared to vary in ways indicative of the existence of barriers to reasonable access to services, but in ways which differed between groups.

We conclude, therefore, that policy-informing exploration of issues of reasonable access to health-care delivery should recognize explicit heterogeneity in population samples. The findings of this analysis were limited by the fact that the types of nurse and contact were not specified, and by the small sample size. Nevertheless, they indicate that barriers to reasonable access, other than income, do exist. We have, though, pointed to some hypotheses concerning nursing services that may warrant further and more detailed investigation. When such hypotheses have been tested, we may be better able to assess the policy implications of the relations between need for care and utilization of services, especially with respect to access to different types of service such as nurses, physicians, and specialists. Such implications require a more precise data set for adequate appraisal and treatment, although this exploratory research indicates that the distribution of services with respect to the population served may require attention.

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