ABSTRACT

The relationship between socioeconomic factors and hospital use is not well understood in the Canadian context. We used the 1991 Canada census and 1990-92 Ontario hospital discharge abstracts for residents of southeast Toronto to calculate crude and age-sex adjusted rates of hospital admission, bed days, and costs by quintile of low-income households. Population-based rates of admission to hospital, bed days and costs were all significantly related to census tract income ($p<0.01$ for males and females). The number of admissions per person admitted was significantly associated with census tract income ($p<0.01$ for males and females), but length of stay and resource intensity weight were not. Hospital costs were 50.0% higher for the poorest quintile of neighbourhoods than for the wealthiest and 35.8% higher than for the middle-income quintile. Poor urban neighbourhoods may require more resources than previously anticipated, related to higher hospital admission and readmission rates.

ABRÉGÉ

On ne comprend pas bien le rapport qui existe, au Canada, entre les indices socio-économiques et l'utilisation des services hospitaliers. Nous avons utilisé les données du recensement du Canada de 1991 et les résumés de congés d'hôpitaux des résidents du territoire du sud-est de Toronto, de 1990 à 1992, pour calculer les taux brutes et les taux ajustés (selon l'âge et le sexe), des admissions hospitalières, des jours-lits, et des coûts, pour chacun des quintiles de foyers à faibles revenus. Le taux d'admissions hospitalières pour chaque (population), de jours-lits et des coûts, étaient tous reliés, dans une mesure statistiquement significative, aux catégories de revenus ($p<0.01$ pour les hommes et les femmes), mais la durée de l'hospitalisation et l'intensité des ressources requises ne l'étaient pas. Les coûts hospitaliers encourus par le quintile des quartiers les plus pauvres étaient 50,0 % plus élevés que ceux des plus riches et 35 % plus élevés que ceux des quintiles à revenus moyens. Il est possible que les quartiers urbains pauvres requièrent plus de ressources qu'il ne l'avait été prévu, dû à des taux d'admissions et de réadmissions plus élevés.

The Nature of Increased Hospital Use in Poor Neighbourhoods: Findings from a Canadian Inner City

Richard H. Glazier, MD, MPH,[1-6] Elizabeth M. Badley, PhD,[2,4,5,7] Julie E. Gilbert, MSc,[3] Lorne Rothman, PhD[8]

It has been appreciated for a long time that socially disadvantaged people experience higher rates of illness, disability and death.[1-4] In Canadian settings, health surveys[5,6] and secondary database analyses[7-10] have demonstrated higher morbidity, hospital utilization, and mortality among people with low income. However, the nature of the impact of socioeconomic status on hospital utilization has not been fully delineated. Increased rates of admission and readmission as well as increased length of stay were found for low-income populations in Winnipeg,[7] but few data are available for other Canadian settings. The impact of poverty on case mix and overall costs in Canada has not been examined.

If socioeconomic factors are strongly related to hospital utilization, it might be desirable to adjust hospital staffing patterns, services, and funding to account for this effect. For instance, a funding adjustment for low-income neighbourhoods has been in place in Britain for general practice for many years.[11] Certain aspects of hospital use such as higher rates of readmission and longer stays also may have significant implications for provision of public health services, health promotion strategies, community services, and ambulatory clinical care.

The purpose of this study is to explore the relationship between neighbourhood income and different aspects of hospital utilization. In order to reduce variation due to geographic access to hospital and physician services and to allow for the local application of these findings, we chose to use a relatively small geographic area in the inner city of Canada's largest metropolitan area.

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METHODS

Setting

The portion of the City of Toronto included in the study is approximately 16 square kilometres in size, containing 28 census tracts ranging in population from 1,135 to 14,000 people. Its boundaries correspond with those used by the Toronto Public Health Department as well as many of the area's health service agencies. According to the 1991 Canada census, this area had a population of 122,830, containing 19% of the total population of the pre-1998 City of Toronto and 17% of the city's land mass. During the study time period, the area had three acute care hospitals and over 100 health and social service agencies within its boundaries. The study area including its census tracts and acute care hospitals appears in Figure 1. It is among Canada's most diverse areas, containing urban neighbourhoods that are among the country's wealthiest, poorest, and most densely populated. The area is home to a large gay population as well as large numbers of recent immigrants and

visible minorities, mainly from Asia, Africa and the Caribbean.

Data sources

Discharge abstracts for all acute care hospital separations (discharges, transfers or in-hospital deaths) in Canada are entered into a computer database by the Canadian Institute for Health Information, CIHI (formerly Hospital Medical Records Institute, HMRI). Qualified technicians code information from discharge summaries, pathology reports and operative notes according to the International Classification of Diseases for diagnoses and the Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures for procedures. This report is based on HMRI data using separations from all acute care Ontario hospitals for residents of southeast Toronto for 1990, 1991 and 1992 fiscal years. Statistics Canada provides a Postal Code Conversion File which we used to match postal codes for hospital separations in the HMRI data set with census tracts in southeast Toronto. For all of our analyses, we used the 1991 Canada census and the unit of analysis was the census tract.

Quintile analyses

We calculated crude and directly age-sex adjusted[12] rates of hospital admission, bed days, and cost for each of the 28 census tracts in southeast Toronto using average annual rates over three years. The 1991 population of southeast Toronto was used as the standard population for age-sex adjustment. We grouped census tracts into income quintiles using percent of households with low income, as defined by Statistics Canada.[13] Hospital rates were expressed in two ways: as individuals admitted, not including multiple admissions by the same individual; and also as all admissions including readmissions. We calculated bed days by multiplying each hospital admission by its length of stay and summing the number of days. Costs were estimated using resource intensity weights (RIW), a relative measure of expected costs, calculated to be specific for each case mix group (CMG).[14] The RIW for each admission was multiplied by the average cost per RIW at The Wellesley Hospital, a major teaching hospital in southeast Toronto at the time of the study. The resulting total cost was divided by the population to arrive at a cost per 1000 population. Hospital rates, bed days, and costs per population were calculated for each census tract.

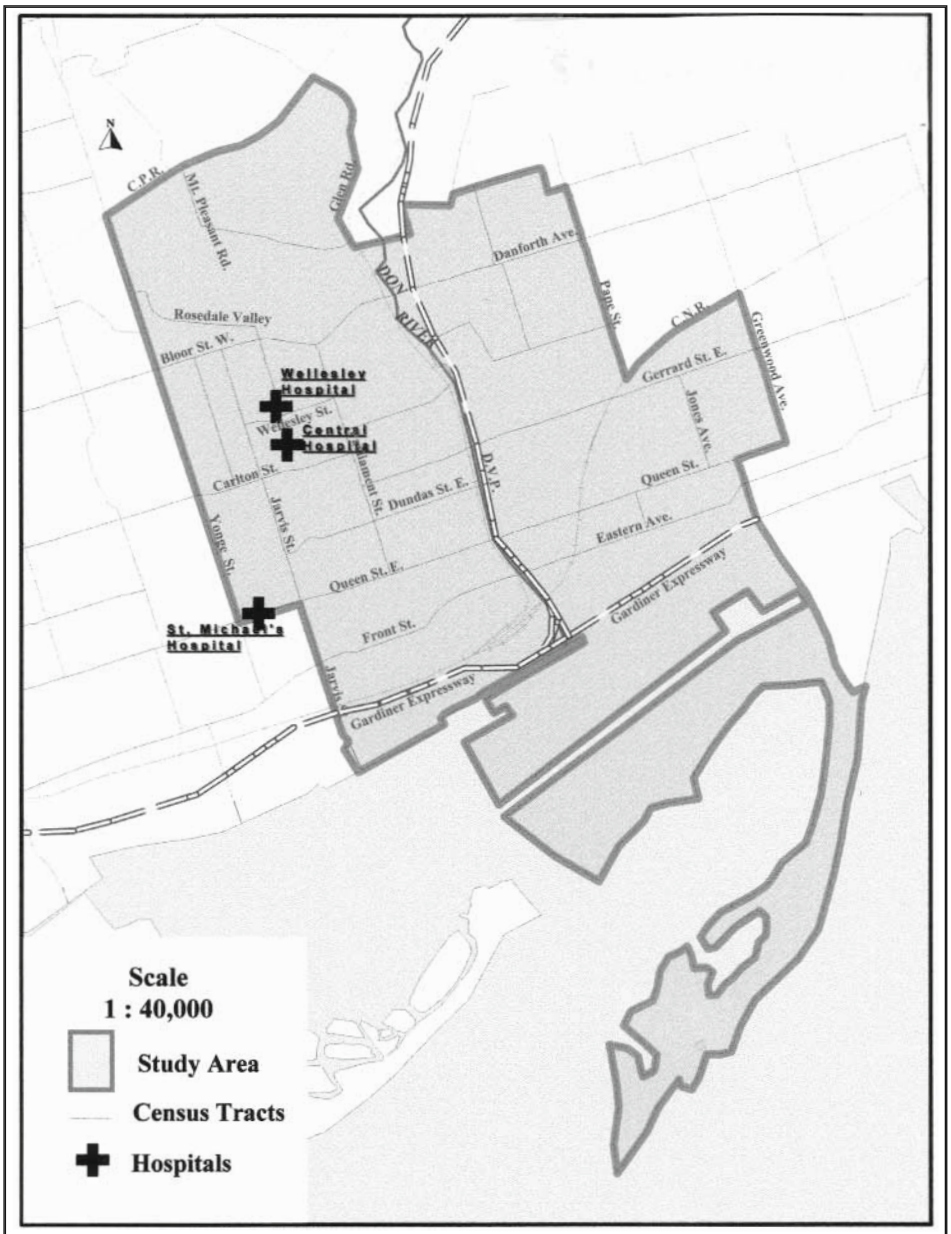

Figure 1. Census tracts and locations of hospitals in southeast Toronto

Among those admitted, the average number of admissions, the average length of stay, and the average RIW were examined by income quintile. Stratified analyses were performed for males and females and for the age groups 0-19 years, 20-44 years, 45-64 years and 65 years and over.

Normal obstetrical deliveries were excluded from all analyses. One census tract in the poorest area of southeast Toronto had a low response to the 2B portion of the census resulting in suppression of its income values by Statistics Canada. This census tract was included in the lowest income quintile.

Regression analyses

We used multiple linear regression to examine the statistical significance of the relationship between income and hospital utilization making use of the variables specified in the quintile analyses, above. Regression analyses included three years of data and used the census tract as the unit

TABLE I
Demographic and Income Characteristics of Southeast Toronto and Distribution by Quintile, 1991 Canada Census

	Among the 28 Census Tracts		Quintiles of % Households with Low Income*				
	Median	Range	Q1 wealthiest	Q2	Q3	Q4	Q5 poorest
Median age	32	(27, 47)	37	32	32	32	32
M:F ratio	1.02	(0.77, 1.81)	0.90	1.06	1.09	1.11	1.07
% of households low income*	24.5	(4.9, 67.7)	11.7	18.6	23.5	30.3	50.46
Median household income ($Cdn)*	$37,411	(12,634, 141,380)	$59,056	$45,830	$40,516	$36,009	$23,834

* data from one census tract suppressed by Statistics Canada

TABLE II
Population-based Crude and Age-sex Adjusted Rates of Hospital Admission, Bed Days and Costs and Distribution by Quintile, Southeast Toronto, 1990-1992

	Overall Rates	Quintiles of % Households with Low Income				
		Q1 wealthiest	Q2	Q3	Q4	Q5 poorest
Individuals admitted per 1,000 population	73.21					
Crude rate		67.33	64.91	63.96	76.57	84.96
Age-sex adjusted rate		60.86	65.00	67.00	75.54	87.51
Admissions per 1,000 population	111.57					
Crude rate		98.23	95.23	95.91	119.15	133.38
Age-sex adjusted rate		88.06	96.09	100.94	118.43	136.56
Bed days per 1,000 population	1023.35					
Crude rate		985.66	808.25	816.28	1134.94	1232.18
Age-sex adjusted rate		814.39	817.32	917.91	1104.01	1293.04
Cost per 1,000 population ($1000 Can)*	$556.93					
Crude rate		$ 544.88	$ 453.61	$ 453.86	$ 613.33	$ 654.53
Age-sex adjusted rate		$ 455.75	$ 458.11	$ 503.50	$ 597.49	$ 683.85

* Average cost per 1,000 population, at average resource intensity weight (RIW), expressed in thousands of dollars Canadian

of analysis. The mean age for each census tract was included in these models as an independent variable and separate models were constructed for males and females. The census tract with suppressed 2B census information was excluded from these analyses. All analyses were performed using SAS (SAS Institute, Inc., 1994).

The protocol for this study was approved by the Wellesley Hospital Research Ethics Committee. Health numbers and other identifying information were scrambled to ensure the anonymity of personal health information.

RESULTS

The demographic characteristics of southeast Toronto are found in Table I, demonstrating a wide range of median age, male:female ratio, and especially income among census tracts. Of note, the wealthiest income quintile has a population that is somewhat older and more female than that found for the remaining quintiles.

The mean annual number of admissions from 1990 through 1992 inclusive was 15,423 among the 122,790 residents of southeast Toronto (125.6 admissions per 1,000 people). On average, health numbers were unavailable for 260 admissions (1.7%) each year. We excluded normal obstetrical deliveries (1,336 admissions per year), and people with invalid or missing age or sex values (127 admissions per year). Our analyses were based on the resulting 13,700 admissions per year distributed among an average of 8,992 individuals.

Age-sex adjusted rates rise with each successively poorer income quintile for individuals admitted, all admissions, bed days and average cost (Table II). The average cost in the poorest quintile is 50.0% higher than that in the wealthiest quintile and 35.8% higher than in the middle quintile.

Among individuals admitted to hospital, the average number of admissions per individual rises slightly with successively poorer income quintiles (Table III). This slight increase across income quintiles is similar in each age group, except for children where it is not apparent. Average length of stay and average RIW show increases with age, but few consistent patterns across income quintiles.

Results of regression analysis show a positive relationship between low income and individuals admitted, all admissions, bed days, and cost for both males and females (Table IV). Age was also significantly associated with the same outcomes. Partial regression plots illustrating the relationships for admissions and cost with the effects of age removed are found in Figures 2 and 3, respectively.

Among individuals admitted to hospital, there was a significant positive relationship between low income and the average number

TABLE III
Admissions per Individual, Length of Stay, and Resource Intensity Weight Among Individuals Admitted, Southeast Toronto, 1990-1992, Stratified by Age, by Income Quintile

	Overall Rates	Quintiles of % Households with Low Income				
		Q1 wealthiest	Q2	Q3	Q4	Q5 poorest
Average number of admissions	**1.52**	**1.45**	**1.48**	**1.51**	**1.57**	**1.56**
0-19 years	1.75	1.63	1.79	1.68	1.88	1.73
20-44 years	1.41	1.32	1.36	1.39	1.45	1.45
45-64 years	1.55	1.40	1.45	1.56	1.58	1.64
65+ years	1.61	1.59	1.55	1.62	1.60	1.65
Average length of stay (days)	**9.17**	**10.04**	**8.49**	**8.51**	**9.53**	**9.24**
0-19 years	5.15	5.61	5.28	5.02	5.47	4.89
20-44 years	6.44	6.24	6.26	6.44	6.49	6.55
45-64 years	9.48	7.39	9.10	9.00	10.07	10.32
65+ years	15.62	15.47	14.40	15.01	16.01	16.24
Average resource intensity weight	**1.64**	**1.82**	**1.56**	**1.55**	**1.69**	**1.61**
0-19 years	0.93	1.04	0.99	0.93	0.91	0.88
20-44 years	1.21	1.21	1.23	1.24	1.22	1.19
45-64 years	1.76	1.55	1.71	1.67	1.90	1.83
65+ years	2.61	2.62	2.45	2.54	2.67	2.67

TABLE IV
Regression Model Showing Parameter Estimates and Level of Statistical Significance for Low Income Households and Age, Stratified by Gender for Census Tracts in Southeast Toronto, 1990-1992

Dependent Variable	Sex	n	Model R^2	Independent Variable – Parameter Estimate		
				Low Income	Age	Intercept
A) Among population						
Individuals admitted per 1,000	M	27	0.47 ***	2.50 **	11.37**	-263.12
	F‡	26	0.41 **	3.09 ***	8.05 *	-117.29
Admissions per 1,000	M	27	0.56 ***	4.75 ***	20.25 ***	-510.97
	F‡	26	0.53 ***	5.24 ***	13.11 **	-241.99
Bed days per 1,000	M†	27	0.44 ***	0.017 **	0.085 ***	4.60
	F†	27	0.45 ***	0.017 **	0.072 ***	5.03
Cost per 1,000 ($1,000 Can) ¶	M†	27	0.47 ***	0.017 ***	0.086 ***	4.02
	F†	27	0.40 **	0.016 ***	0.066 *	4.66
B) Among admitted individuals						
Number of admissions/admitted individual	M	27	0.37 **	0.003 **	0.009*	1.213
	F	27	0.28*	0.003 **	0.004 NS	1.236
Average length of stay (days)/admission	M†	27	0.15 NS	0.001 NS	0.016 NS	1.73
	F†	27	0.56 ***	0.004 NS	0.040 ***	0.619
Average resource intensity weight/admission	M a	27	0.26 *	<0.001 NS	0.016 *	0.037
	F†,‡	26	0.61 ***	0.002 NS	0.031 ***	-0.754

† - log-transformed; ‡ - outlier removed; ¶ - Average cost per 1,000 population, at average resource intensity weight (RIW), expressed in thousands of $Canadian
* = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.005$; NS = not significant

of admissions for males and females after controlling for the effects of age. Low income was not significantly associated with length of stay or RIW. Age had a positive relationship with the average number of admissions for males, length of stay for females, and average RIW for males and females.

DISCUSSION

In a heterogeneous Canadian inner city, rates of admission and readmission rise consistently with increasing poverty, resulting in significantly increased hospital costs for poor neighbourhoods. These costs are 50% more for the poorest neighbourhoods than for the wealthiest and one third more than for neighbourhoods with average income. In this setting, length of stay and case mix are similar across neighbourhoods and do not contribute to increased costs.

Higher rates of hospital admission among those with socioeconomic disadvantage have also been demonstrated in Canadian[5-8] and European settings,[15-18] and for a variety of health problems and age groups in the U.S.[19-26] The explanation for these higher hospital rates appears to be most closely tied to higher levels of morbidity, related in part but not entirely to health habits.[27,28] The underlying mechanisms producing excess morbidity are not well understood.[3] Lack of care providers at home, impaired access to outpatient medications, and physician perception of the inability of patients to follow up as outpa-

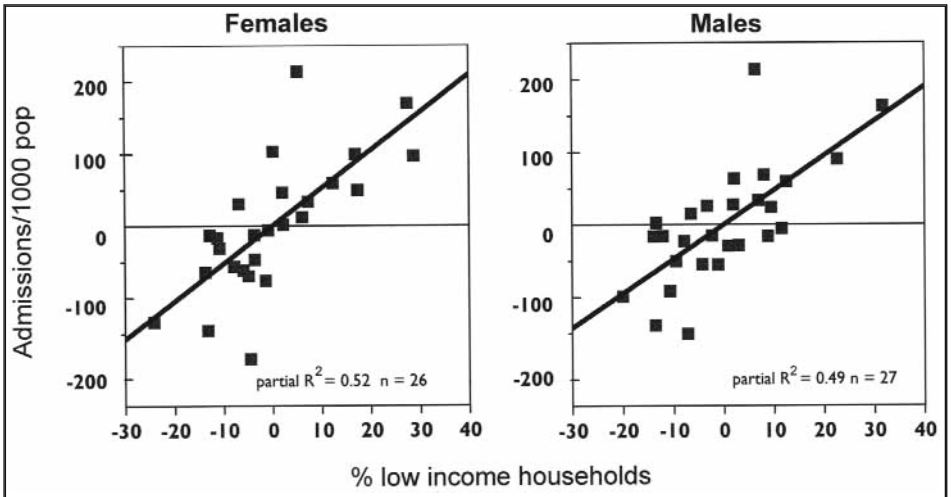

Figure 2. Residual scatterplot and partial correlations for percent low income households and admissions per 1,000 population, for females and males, southeast Toronto, 1990-1992

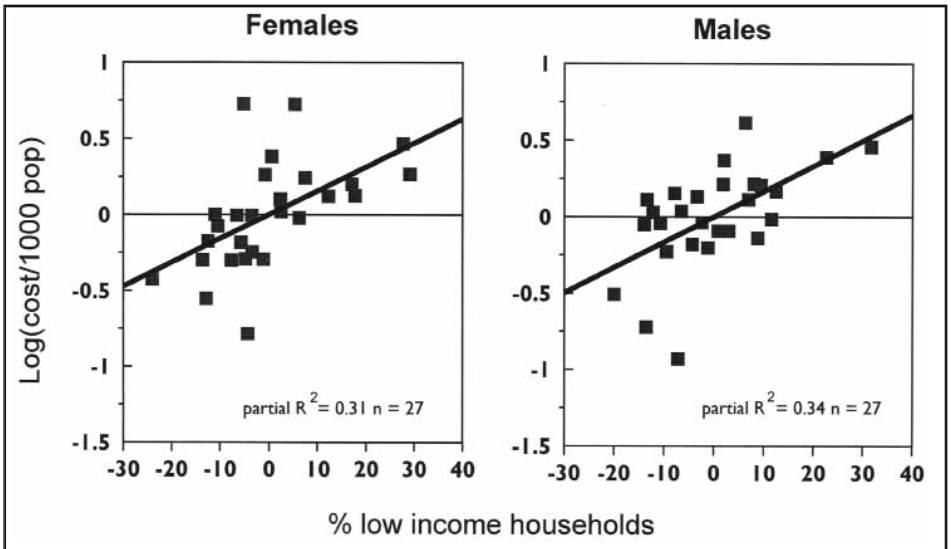

Figure 3. Residual scatterplot and partial correlations for percent low income households and average cost per 1,000 population expressed in thousands of $Canadian, for females and males, southeast Toronto, 1990-1992

tients are additional factors that could contribute to higher rates of hospital admission among people with socioeconomic disadvantage. These factors have not been well investigated and are poorly understood.

These findings should be interpreted with caution for several reasons. Southeast Toronto is a relatively small and unusually heterogeneous geographic area and findings here may not be directly applicable to other Canadian urban areas. We made use of administrative data which were collected for purposes other than this study and which had incomplete information on the health number and area of residence of some individuals. The average cost per RIW varies by hospital, so the actual dollar amount is affected by our use of one hospital's costs. Since cost per RIW is a constant, the choice of hospital does not affect the relative differences between income quintiles and census tracts. The use of average cost per RIW as a measure of hospital costs is crude in relation to currently available costing methods, but more sophisticated measures require special investigations which extend well beyond the limits of administrative data.

The use of area rather than the individual as the unit of analysis does not permit attribution of these findings to individuals and their income levels. There have been recent calls for the use of area and multilevel analyses to reflect the role of macrolevel variables in shaping health and disease in populations.[29] An advantage of using area as the unit of analysis is that it permits examination of contextual effects on health rather than just individual effects. Another advantage is in the policy arena where adjustments in planning and resource allocation can be made on the basis of geographic areas rather than for individuals.

These findings hold several implications for public health policy, resource allocation, and hospital management. To the extent that higher admission rates in poor neighbourhoods are due to excess morbidity, this can be addressed at the community level through health promotion strategies, public policy initiatives, and by ensuring adequate access to public health and ambulatory clinical services. Readmission could be addressed through discharge planning and community care which recognized the increased needs of people living under adverse socioeconomic circumstances. Hospitals serving poor neighbourhoods may face important incremental costs, based mostly on higher rates of admission and readmission. Higher admission rates would be expected to place greater burdens on hospital emergency departments, admitting departments, billing departments, ward capacity, and discharge planning.

This study is the first in a Canadian setting to examine in detail the impact of poor neighbourhoods on different aspects of hospital utilization. We conclude that Canadian policy makers should take account of the income levels of the neighbourhoods served by hospitals when deciding on resource allocation for public health, ambulatory care, community services, and hospitals. Further study of these phenomena to gain a better understanding of why the observed differences occur is desirable.

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LETTERS/CORRESPONDANCE

To the Editor:

I read with interest Richard G. Mathias' editorial, "Realigning Health Canada: Form Before Function?", in the May/June issue of your journal and would like to offer a few comments. Dr. Mathias concludes that in undertaking its Realignment, Health Canada has placed form before function. In fact, the Realignment we announced on April 17 is the culmination of a thorough, but perhaps less visible, process we undertook last summer – an analysis of functional issues that was reported in a series of documents called, "Program Impact Assessment Reports." We would be pleased to provide copies to anyone who is interested.

These reports, the result of multi-disciplinary and multi-branch reviews, enabled us to conclude that we needed to strengthen the linkages between health protection and promotion, between surveillance and intervention, and between regulation and public involvement. We also found that our links with external stakeholders and with provincial and territorial governments were not as coherent and strategic as they could be. And finally, we saw a need for greater coordination among our internal operations.

Injury prevention and mental health – two issues that Dr. Mathias himself raises in his editorial – are good examples of how the process worked. Our analysis last year showed the need to focus more attention on these areas. This, in part, led to our decision to bring surveillance and interventions closer together.

Having realigned the Department to strengthen it and improve horizontal management, we have now begun to identify our strategic priorities for the next year, and will share them with Canadians later this year. Health Canada's mission is to help the people of Canada maintain and improve their health. That mission has not changed, nor have our legal obligations and limitations. Any assistance the public health community can give us to fulfil this mission is gratefully accepted.

David A. Dodge, Deputy Minister
Health Canada

Author's reply:

The response from David Dodge, Deputy Minister of Health, states process in arriving at the change of the Health Protection Branch but, even as the original documentation was weak, gives no information on outcomes that are to be achieved by the realignment or how the changing of names and groups without specifically changing the tasks and responsibilities is sufficient?

A quote from Mr. Dodge – "we have now begun to identify our strategic priorities for the next year" – is indicative of the form before function approach rather than the determining of strategic priorities and realigning to meet the strategic needs of Health Canada. The Emperor's new clothes are not very substantial and certainly will not give protection from the winds of change without purpose-specific design.

Richard G. Mathias
University of British Columbia