Health Region Peer Groups 2003

June 2004

Health Region Peer Groups 2003

Logan McLeod
Health Statistics Division
Statistics Canada

Phone (613) 951-4800
Email: logan.mcleod@statcan.ca

This paper is an update to the working paper '*Health Regions Peer Groups'* written by Larry MacNabb of the Health Statistics Division of Statistics Canada (2002). The purpose of this paper is to outline data and methodological differences relative to the initial Peer Group 2000 classification and to present the results of the Peer Group 2003 classification.

The author wishes to acknowledge the considerable contributions of Jason Gilmore and Larry MacNabb towards this paper.

Table of Contents

1. Introduction

To remain current with respect to data availability and health region boundary definitions[1], it was necessary to update the Health Region Peer Group 2000 classification. In November 2003, a revised set of peer groups were released in the *Health Indicators* product. The final result was the creation of nine peer groups of health regions, representing all health regions across Canada.

The input data, methodology, empirical techniques and results of the Peer Group 2000 classification were outlined in the working paper '*Health Regions Peer Groups'* written by Larry MacNabb of the Health Statistics Division of Statistics Canada. This paper was created as a result of guidance and support of the Peer Group Project Working Group. This working paper was released via the *Health Indicators* Internet product (82-221-XIE) in May 2002.

The purpose of this paper is to outline data and methodological differences relative to the initial Peer Group 2000 classification, present the results of the Peer Group 2003 classification.

2. Data

As noted in the original working paper, variables describing the socio-economic and socio-demographic determinants of health within health regions where used in the clustering algorithm to produce peer groupings. The Peer Group 2003 classification uses more recent data from Census 2001, wherever available. The variables used are outlined in Appendix A. See the original paper for all other details related to Data.

Four new variables were used in place of similar variables that were used in the previous classification. The new variables are:

I. Income

The average household income for a health region was used instead of the health regions average personal income. Average household income is more representative of the economic situation faced by families and communities compared with personal income.

II. Education

The proportion of the population age 25-54 with a post-secondary diploma, certificate or degree was used instead of the average number of years of schooling (for the same population). The reason for this change is that the average number of years of schooling is no longer produced.

[1] The most recent health region boundaries are those as of June 2003.

III. Immigration

There are two changes to the immigration variable used. First, recent immigrants are now defined as individuals who immigrated to Canada in the previous 10 years (1991 – 2001). Before, recent immigrants were defined as those individuals who immigrated to Canada in the previous 15 years (1981 – 1996).

Secondly, the share of recent immigrants relative to the total population was used instead of the share of recent immigrants relative to the total immigrant population. This change was made because it was felt that immigrants as a proportion of the total population would be more representative of the impact the recent immigrant population has on a health region.

IV. Population Growth

The variable used to define population growth is based on the 1996 and 2001 Census population estimates. Previously, the 1995 – 1997 population estimates derived by the Demography Division were used. This change was made because of the availability of more recent data and the availability of an inter-census growth estimate (1996-2001) rather than demographic population growth estimates (1995-1997).

3. Methodology

The methodology described in sections 3.1 and 3.2 of the original working paper were replicated for the Peer Group 2003 classification. See the original working paper for details. SAS version 8 was used to run the clustering algorithm.

3.3 Number of Clusters

As was outlined in the original working paper:

> *One of the major problems with cluster analysis is selecting the appropriate number of clusters. Several criteria have been suggested (Everitt, 1993) which generally involve the optimisation of one or more test statistics. From a practical perspective it is generally left up to the analyst to determine the number that best suits a given need.*

The same rationale was used for selecting the appropriate number of starting clusters[2]. The average number of health regions per cluster was set at seven, which would yield a maximum of 18 clusters. The maximum number of clusters is lower than the original working paper since there are fewer health regions in total.

[2] To remain consistent with the statistical exercise of defining peer groups through cluster analysis, the term cluster will be used instead of peer group.

4. Results

4.1 Standardization of Variables

The variables are standardized in the same manner as in the original working paper. All variables were standardized to mean 0 and unit variance.

4.2 Initial Clusters

To establish a starting point, the clustering algorithm was instructed to group the 127 health regions into 18 clusters. There were in fact 18 clusters produced, with 8 health regions assigned to a cluster of one (Table 4.2.1). This indicates that 18 clusters would be too many given the objective of assigning peer groups is to be able to compare like health regions. There are two clusters that contain the majority of health regions (B and H); both have the lowest root mean squares standard deviation and the lowest distance between cluster centers.

Table 4.2.1: Initial Classification of Health Regions into 18 Clusters

Cluster	Frequency	RMS Std	Radius	Nearest Cluster	Distance Between Cluster Centers
A - (6201 Nunavut)	1	..	0.00	C	6.63
B	51	0.51	5.01	H	2.82
C - (2417 Région du Nunavik)	1	..	0.00	A	6.63
D	5	0.63	4.79	L	3.82
E - (1005 Grenfell Regional Health Services Board)	1	..	0.00	Q	7.47
F	11	0.52	4.28	H	3.05
G - (2418 Région des Terres-Cries-de-la-Baie-James)	1	..	0.00	C	7.29
H	27	0.54	5.01	B	2.82
I	2	0.58	4.00	R	4.28
J - (5931 Richmond)	1	..	0.00	L	7.09
K	2	0.67	4.66	F	8.12
L	5	0.64	4.99	D	3.82
M - (3595 City of Toronto Health Unit)	1	..	0.00	N	5.53
N - (2406 Région de Montréal-Centre)	1	..	0.00	M	5.53
O - (5932 Vancouver)	1	..	0.00	M	6.61
P	2	0.51	3.53	I	5.22
Q	12	0.58	4.75	F	4.78
R	2	0.61	4.20	F	3.19

This indicates that the initial number of clusters (18) is too high given the need for having comparable regions in a cluster. Clusters B and H are comprised of regions which are very similar (as both clusters are large and have low standard deviations). The fact that they are nearest neighbours also indicates that all the regions in these clusters are very similar.

The first two principal components account for just over 53% of the total variability. The first principal component appears to be measures of urbanicity (housing affordability, proportion of immigrants, proportion of visible minorities, proportion of post-secondary graduates, average dwelling value, etc.). The second principal component seems to be measures of income inequality

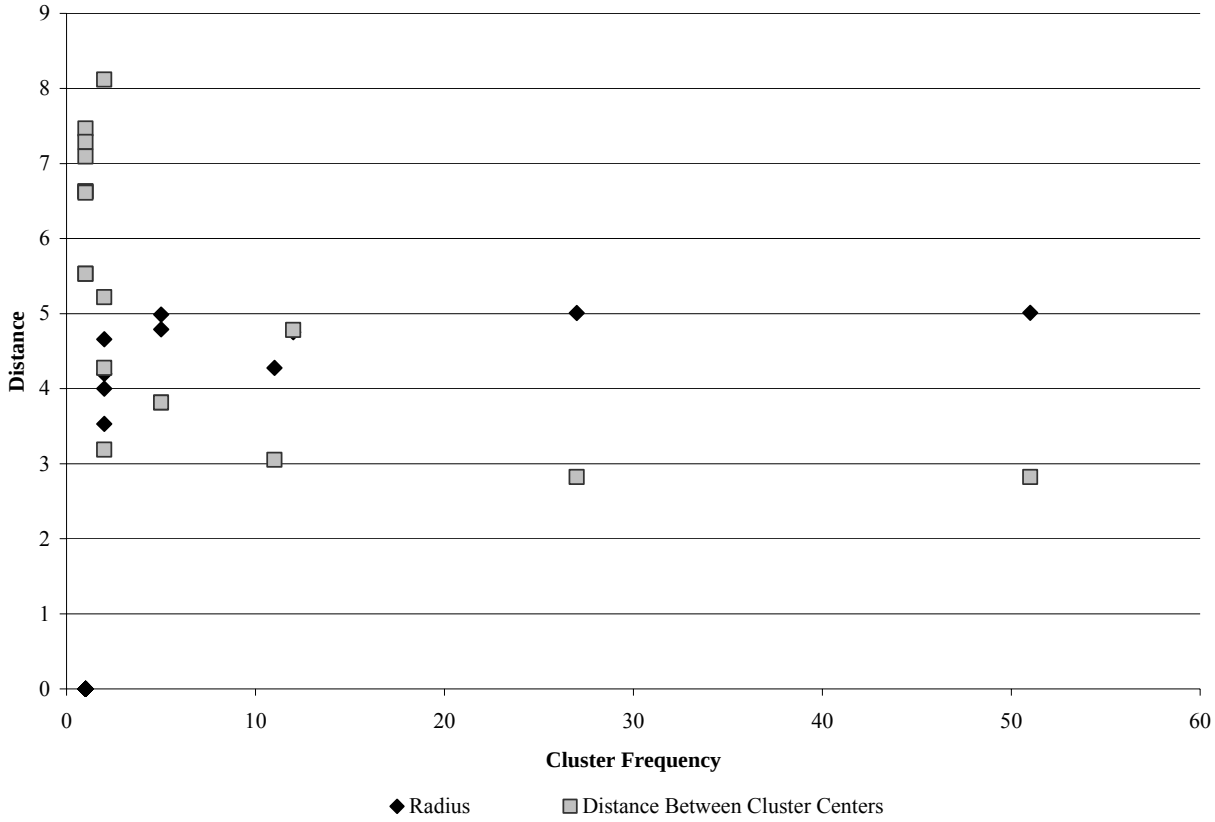
(proportion of low-income children, proportion of low-income individuals aged 15 plus, share of total income held by the lower 50th percentile of households, etc.). A summary of the results from the principal component analysis including all eigenvalues and the first five principal components for the correlation matrix can be found in Appendix B.

This is similar to the results found in the original working paper. The first two principle components in the original working paper were also measures of urbanicity and poverty. They also accounted for approximately 53% of the total variability. What this is telling us is that the variables which drive the analysis are remaining fairly consistent over time.

There were three more factors that added nearly 30% more variability to the model. Overall there were five principle components that accounted for 81.5% of the variability in the model.

Ideally, given a set number of groupings, clusters should be separated by approximately the same distance. A plot of cluster frequency versus cluster radius and distance between clusters provides a good indication of the appropriate cluster spacing given the number of clusters required (Figure 4.2.2). It appears that setting a maximum cluster radius of 6 would ensure adequate spacing between clusters and ensure that most health regions can be assigned to a cluster while minimizing the effect of outlying health regions.

Figure 4.2.2: Cluster frequency versus radius and distance between clusters for the initial 18 health region peer groupings.



4.3 Exclusion of Outliers

The FASTCLUS procedure was rerun using the cluster means from Table 4.2.1 for all clusters with a frequency greater than one as initial seeds. The maximum number of clusters was now set to 10, resulting from the first iteration of the analysis that indicated that 18 clusters were more than the data could support.

Table 4.3.1:
Cluster means for groupings from Table 4.2.1 with more than one health region as seeds

Cluster	Frequency	RMS Std	Radius	Nearest Cluster	Distance Between Cluster Centers
A	23	0.33	12.48	C	9.76
B	13	0.48	16.28	A	13.76
C	26	0.33	11.33	A	9.76
D	10	0.36	13.43	E	12.45
E	25	0.34	21.12	A	10.84
F	5	0.88	22.95	J	29.30
G	4	0.76	18.99	B	36.80
H	2	0.53	6.30	J	19.28
I	10	0.46	22.20	C	17.74
J	9	0.41	12.89	C	11.08

The FASTCLUS procedure was rerun again using the cluster means from Table 4.3.1 (for all clusters with a frequency greater than one) as initial seeds. Any health region with a distance of six or greater to its nearest cluster center was excluded from the analysis to minimizes the impact of outlying health regions on the analysis.

Table 4.3.2:
Maximum cluster radius of 6 using cluster means for groupings from Table 4.3.1

Cluster	Frequency	RMS Std	Radius	Nearest Cluster	Distance Between Cluster Centers
A	24	0.47	3.47	C	2.37
B	13	0.67	4.18	A	4.12
C	23	0.44	2.98	A	2.37
D	10	0.50	3.64	C	3.16
E	25	0.45	3.34	C	3.09
F	3	1.07	4.72	J	8.04
G	3	0.91	4.05	B	9.87
H	3	0.79	3.95	J	4.93
I	9	0.56	3.89	C	4.63
J	10	0.55	3.75	C	3.17

Finally, excluded health regions were combined with their nearest cluster. This had minimal effect on the resulting peer groups (Table 4.3.3).

Table 4.3.3:
Cluster statistics after combining excluded health regions with their closest cluster

Cluster	Frequency	RMS Std	Radius	Nearest Cluster	Distance Between Cluster Centers
A	24	0.47	3.47	C	2.37
B	14	0.78	8.11	A	4.25
C	23	0.44	2.98	A	2.37
D	10	0.50	3.64	C	3.16
E	25	0.45	3.34	C	3.09
F	5	1.27	7.67	J	7.99
G	3	0.91	4.05	B	9.53
H	3	0.79	3.95	J	4.93
I	10	0.69	6.90	C	5.10
J	10	0.55	3.75	C	3.17

5. Discussion

5.1 Comparison with Original Analysis Results

The primary similarity with the original working paper is the consistency with respect to the principle components and the strongest predictors. In both analyses, the first two principle components accounted for roughly 53% of the total variability and were composed of similar descriptors.

The first principle component was comprised of measures of urbanicity such as average dwelling value, proportion of visible minorities, type of metropolitan influenced zones and housing affordability. The only notable difference in this analysis is the presence of government transfers as a strong predictor.

The second principle component was comprised of poverty measures. Strong predictors were again consistent with the proportion in low-income (population over 15 years of age), proportion of low-income children (population under 18 years of age) and a measure of income inequality.

5.2 Strongest Predictors

In order to determine which variables played a key role in defining the health region peer groups, the final clusters were run against all 24 variables in the stepwise descriminant analysis (as was done in the original paper). Partial R-SQ statistics for entry and removal were set at 0.15. Any variable which had an R-SQ of 0.5 or higher when regressed against a variable already in the model was removed from the analysis. A summary of the results is found in Table 5.2.1.

The strongest predictors of the final peer groupings are (1) Population Density and (2) Percent of population self-identifying as Aboriginal. Looking at the correlations with other variables, population density was highly correlated with the overall population size, the proportion of

visible minorities and the proportion of recent immigrants as a proportion of the total population. These variables generally define urban or rural localities.

Percent of population self-identifying as Aboriginal tends to be highly correlated with the proportion of the population under the age of 15 and the proportion of lone-parent families.

Table 5.2.1:
Stepwise descriminant analysis of final health region groupings on all 24 variables

Step	Variable	Partial R-SQ	R-SQ Variables in Model
1	**PopDen**	**0.9092**	
	Removed		
(Population Density)	VisMin	0.6963	0.5022
2	**AboPer**	**0.8709**	
	Removed		
	Pop15	0.8121	0.7786
(Aboriginal)	OwnDwl	0.7124	0.5721
	LnePrnt	0.7211	0.5603
3	**GovTran**	**0.8109**	
	Removed		
	Pop01	0.2836	0.5394
	AvgDwl	0.5806	0.5563
	Emp	0.768	0.5701
(Government	Unemp	0.7556	0.5529
Transfer Income)	LTUnemp	0.7569	0.5843
	AvgInc	0.7286	0.6708
	Pop65	0.5563	0.5182
	ImmPer	0.5748	0.562
	PostSec	0.5587	0.5244
4	**MFRat**	**0.4996**	
	Removed		
(Male-Female Ratio)	MIZ	0.3733	0.6709
	HouAff	0.2881	0.5845
5	**Growth**	**0.4808**	
	Removed		
(Population Growth)	MedShr	0.1749	0.502
6	**MigMob**	**0.2861**	
	Removed		
(Migrant Mobility)	Low15	0.1645	0.5106
	LowKids	0.1392	0.5099

5.3 Collapsing Small Clusters

The results from section 4.3 (specifically Table 4.3.3), represent clusters that are evenly spaced and have minimal within cluster variance given the parameters used by the clustering algorithm. Having a cluster containing less than five regions is not practical as it does not provide many options for comparison. In order to provide more peers for comparison, clusters with less than five members were combined with their nearest neighbour. The exception is cluster G (Montréal, Toronto and Vancouver). Cluster G was not combined with another cluster.

There was only one cluster that was joined with its closest neighbour. Cluster J (health regions 1006, 2409, 2410, 3549, 3556, 4670, 4710, 5951, 5952 and 5953) was combined with cluster H (health regions 4828, 6001 and 6101). Summary statistics of the final peer groups can be found in Appendix C and a list of health regions in each peer group can be found in Appendix D along with their respective groupings through each step of the analysis.

5.4 Peer Group Descriptions

The six final variables from the stepwise descriminant analysis were used to represent each of the clusters. The mean values for each peer grouping can be found in Appendix C. For each of the seven variables, the median, 1st and 3rd quartiles of the mean peer group estimates were calculated. Values were classified based on the following ranges.

High: **X** > Median + (1.5 * Interquartile Range)
Medium: Median + (1.5 * Interquartile Range) ≥ **X** > Median
Low: Median ≥ **X** > Median + (1.5 * Interquartile Range)
Very Low: Median + (1.5 * Interquartile Range) > **X**

The results from this classification can be found in Table 5.4.1. While the methodology is crude as a descriptive tool, it does help to distinguish one peer groups' characteristics from another. For each peer group, only the variables required to distinguish them from another peer group are reported. For example, peer group E is the only peer group with medium population density and medium Aboriginal concentration.

Table 5.4.1:
Final peer grouping descriptions based on seven factors resulting from the stepwise descriminant analysis

Cluster	Population Density	Percent Aboriginal	Government Transfer Income	Male-Female Ratio	Population Growth	Internal Migrant Mobility
A	Medium	Very Low				
B	High	Very Low	Very Low	Very Low	Medium	Medium
C	Very Low	Very Low	Medium			
D	Very Low	Medium				
E	Medium	Medium				
F	Very Low	High	Medium			
G	High	Very Low	Very Low	Very Low	Medium	Very Low
H	Very Low	High	Very Low			
I	Very Low	Very Low	High			

5.5 Geographic Limitations

Each province and territory defines the geographic boundaries for a health region based on administrative preference. There are two instances where smaller health regions are combined with another near by small health region to ensure that sample survey estimates will attain a sufficient coefficient of variation to be reportable.[3] This is one of the major limiting factors affecting the peer group exercise.

Health regions can be strictly urban or rural or some combination of the two. This lack of homogeneity in defining health region boundaries makes the exercise of assigning health regions to peer groups much more difficult as it can have a large impact on the degree to which a variable represents a specific region and in some cases important defining factors may be missed.

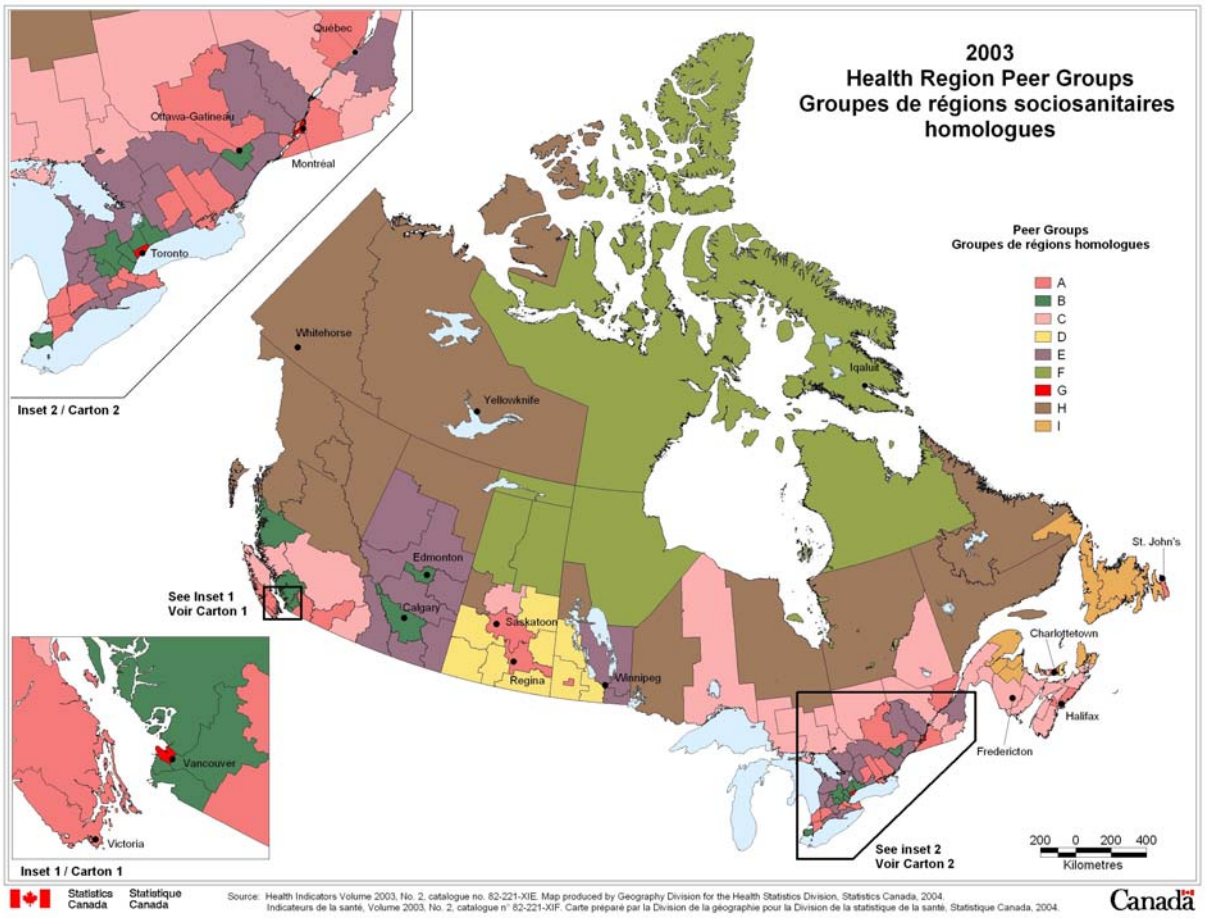
5.6 Geographic Representations of Final Peer Groups

The map of the final peer groups show visually the geographic clustering of the health regions into their final peer groupings. Montréal, Toronto and Vancouver form the smallest cluster based on the size and diversity of their populations. The regions around them have tended to cluster together forming another peer group.

There are some definite clusters of health regions that formed based on their location within Canada. The northern regions have clustered based on the Aboriginal make-up of their communities. A cluster of eastern health regions has formed based on their low population density and high rates of government transfers. All peer groups have representation across provincial and/or territorial borders.

[3] The health regions where this occurs are in northern Manitoba (4680 (Burntwood Regional Health Authority) and 4690 (Churchill Regional Health Authority) are combined to form 4685 (Burtwood/Churchill)) and northern Saskatchewan (4711 (Mamawetan Churchill River Regional Health Authority), 4712 (Keewatin Yatthé Regional Health Authority) and 4713 (Athabasca Health Authority) are combined to form 4714 (Mamawetan/Keewatin/Athabasca)).

Figure 5.6.1: Map of Final Peer Groupings



6. Summary

As a result of health region boundary changes since January 2000, and the availability of 2001 Census data, it was necessary to update the Peer group 2000 classification. In keeping with the original working paper, the goal was to produce a classification which would cluster health regions with similar social and economic health determinants into peer groups.

Health regions were grouped using a non-hierarchical clustering algorithm which minimised the within cluster sum of squared errors for a predefined number of clusters. Starting with an initial set of 18 clusters and ensuring that each cluster contained at least two health regions; the results indicated that the regions naturally grouped themselves into 10 distinct peer groups. The number of regions in each grouping ranged from 3 to 25.

Stepwise discriminant analysis was used to determine which variables had the most influence on determining the final peer groupings. Overall, the three most important variables were the population density, proportion of Aboriginals and the proportion of income coming from government transfers. The male-female ratio and population growth still had a relatively strong influence on the groupings.

Peer groupings with fewer than five health regions were combined with their nearest neighbour. This was done to provide enough health regions within a peer group for comparison. If a cluster of Montreal, Toronto and Vancouver formed (as it did), it was not forced to join another cluster as these health regions tend to have more in common with themselves than with other health regions. The final result was 9 peer groups ranging in size from 3 to 25. When mapped, peer groups appear to form based on their geography. Further, they also appear to form based on their relative distance to urban centers.

7. References

Andberg MR., Cluster Analysis for Applications. New York: Academic Press, 1973.

Everitt BS., Cluster Analysis, 3rd Edition. Toronto: Halsted Press, 1993.

MacNabb, Larry. "Health Region Peer Groups." *Health Indicators* (Statistics Canada), May (2002), Catalogue Number 822-221-XIE.

SAS Institute Inc., SAS OnilneDoc®, Version 8, Cary, NC: SAS Institute Inc. 1999.

Appendix A: Variable Definitions

1. 2001 Population (Pop01)

Definition: Estimate of the total number of individuals living in a region.

Source: Statistics Canada, Census 2001 (unadjusted)

2. Aboriginal Percentage (AboPer)

Definition: Proportion of a regions' total population self-identifying with an Aboriginal group.

Sources: Statistics Canada, 2001 Census, 2001 Census Coverage Studies, and Demography Division (population estimates)

3. Average Dwelling Value (AvgDwl)

Definition: Average expected value of an owner-occupied, non-farm, non-reserve dwelling (including the value of the land the dwelling is on) at the time of the Census.

Source: Statistics Canada, 2001 Census

4. Average Income (AvgInc)

Definition: Average family income for persons aged 15 and over, from all sources.

Source: Statistics Canada, 2001 Census

5. Post-secondary graduates (PostSec)

Definition: Population aged 25 to 54 who have obtained a post-secondary certificate, diploma, or degree.

Source: Statistics Canada, 2001 Census (special tabulations)

6. Employment Rate (25 to 54) (Emp)

Definition: Number of employed persons aged 25 to 54 divided by the total number of individuals between the ages of 25 and 54 in a given region.

Source: Statistics Canada, 2001 Census (special tabulations)

7. Growth Rate (Growth)

Definition: Percent change in a regions population estimate from 1996 to 2001.

Source: Statistics Canada, 1996 and 2001 Census (unadjusted)

8. Government Transfer Income (GovTran)

Definition: Proportion of all income that came from government transfers (e.g., GIS/OAS, C/QPP, EI, etc.) for the population 15 years of age and older.

Source: Statistics Canada, 2001 Census

9. Housing Affordability (HouAff)

Definition: Proportion of total households spending 30% or more of total household income on shelter.

Source: Statistics Canada, 2001 Census

10. Immigrant Percentage (ImmPer)

Definition: Those immigrants who came to Canada from 1991 to 2001 as a proportion of the total population.

Source: Statistics Canada, 2001 Census

11. Median share of income (MedShr)

Definition: Proportion of income (from all sources) held by the bottom half of all households, based on the median household income for that specific community.

Source: Statistics Canada, 2001 Census (special tabulations)

12. Internal Migrant Mobility (MigMob)

Definition: Proportion of people that lived in a different Canadian municipality at the time of the previous Census (5-year internal migrants). This excludes Canadians in households outside Canada (military and government personnel).

Source: Statistics Canada, 2001 Census

13. Lone-Parent Families (LnePrnt)

Definition: Proportion of lone-parent families among all census families living in private households. A census family refers to a married or common-law couple or lone parent with at least one never-married son or daughter living in the same household.

Source: Statistics Canada, 2001 Census

14. Long Term Unemployment Rate (LtUnemp)

Definition: Proportion of the labour force aged 15 and over who did not have a job any time during the current or previous year.

Source: Statistics Canada, 2001 Census

15. Low Income 15+ (Low15)

Definition: Proportion of persons in economic families and unattached individuals with 2000 incomes below the Statistics Canada low-income cut-off (LICO). The cut-offs represent levels of income where people spend disproportionate amounts of money for food, shelter, and clothing.

LICOs are based on family size and degree of urbanization; cut-offs are updated to account for changes in the consumer price index. Data were not derived for economic families or unattached individuals in the Territories or on Indian Reserves

Source: Statistics Canada, 2001 Census

16. Low Income Children (LowKids)

Definition: Proportion of children under age 18 living in economic families with 2000 incomes below Statistics Canada's low-income cut-offs (LICO). Data were not derived for economic families or unattached individuals in the Territories or on Indian Reserves.

Source: Statistics Canada, 2001 Census

17. Male-Female Ratio (MFRat)

Definition: Total number of males in a given region in 2001 divided by the total number of females.

Source: Statistics Canada, 2001 Census

18. Owner-Occupied Dwellings (OwnDwl)

Definition: Proportion of dwellings in which the owner also lives. Band housing and collective dwellings (i.e. rooming houses, nursing homes, military camps etc.) are excluded from both numerator and denominator.

Source: Statistics Canada, 2001 Census

19. Population Density (PopDen)

Definition: Number of people per square kilometre.

Source: Statistics Canada, 2001 Census and Geography Division (special tabulations)

20. Population under 15 (Pop15)

Definition: Proportion of the population in a given region under the age of 15 (2001 population).

Source: Statistics Canada, 2001 Census (unadjusted)

21. Population 65 Years and Older (Pop65)

Definition: Proportion of the population in a given region aged 65 years and older (2001 population).

Source: Statistics Canada, 2001 Census (unadjusted)

22. Strong MIZ (MIZ)

Definition: Strong MIZ (Census Metropolitan and Census Agglomeration Influenced Zones represents the proportion of the population living in Census Metropolitan Areas (CMAs), Census Agglomerations (CAs) and communities that fall outside CMAs/CAs that have at least 30% of the employed labour force commuting to CMAs/CAs. The larger the proportion, the stronger the relationship between the specific community and a nearby CMA/CA.

Source: Statistics Canada, 2001 Census (special tabulations)

23. Unemployment Rate (Unemp)

Definition: Total number of unemployed individuals 15 and older divided by the total number of individuals 15 and older participating in the labour force.

Source: Statistics Canada, 2001 Census

24. Visible Minority (VisMin)

Definition: Proportion of the population belonging to a visible minority group. As defined by the Employment Equity Act (1986), visible minorities are persons (other than Aboriginal people) who are non-Caucasian in race or non-white in colour.

Source: Statistics Canada, 2001 Census

Appendix B: Principal Component Analysis

	Eigenvalue	Difference	Proportion Explained	Cumulative Proportion
1	7.708	2.589	0.321	0.321
2	5.119	1.018	0.213	0.534
3	4.101	2.583	0.171	0.705
4	1.518	0.407	0.063	0.769
5	**1.111**	**0.235**	**0.046**	**0.815**
6	0.876	0.112	0.037	0.851
7	0.764	0.163	0.032	0.883
8	0.602	0.080	0.025	0.908
9	0.522	0.173	0.022	0.930
10	0.349	0.025	0.015	0.945
11	0.323	0.123	0.014	0.958
12	0.200	0.024	0.008	0.966
13	0.176	0.025	0.007	0.974
14	0.151	0.024	0.006	0.980
15	0.128	0.037	0.005	0.985
16	0.091	0.023	0.004	0.989
17	0.069	0.002	0.003	0.992
18	0.066	0.018	0.003	0.995
19	0.048	0.022	0.002	0.997
20	0.026	0.002	0.001	0.998
21	0.024	0.012	0.001	0.999
22	0.012	0.001	0.001	0.999
23	0.011	0.006	0.000	1.000
24	0.004		0.000	1.000

Appendix B: Eigenvectors for the first six principal components

	Prin1	Prin2	Prin3	Prin4	Prin5
MEDSHR	-0.106	-0.277	-0.069	0.311	0.048
MFRat	-0.146	-0.247	0.166	0.121	0.287
Pop01	0.237	0.125	0.122	0.019	0.130
Pop15	-0.118	-0.232	0.339	-0.163	0.084
AvgDwl	0.298	-0.018	0.134	0.156	-0.020
OwnDwl	-0.028	-0.001	-0.386	0.293	0.062
MigMob	0.112	-0.271	-0.077	-0.157	-0.093
GovTran	-0.276	0.215	-0.078	0.049	0.103
VisMin	0.271	0.122	0.176	0.239	0.260
LnePrnt	-0.077	0.093	0.394	-0.278	-0.248
Emp	0.224	-0.240	-0.182	-0.253	0.159
PopDen	0.197	0.201	0.167	0.030	0.363
MIZ	0.273	0.041	-0.023	-0.037	-0.421
Unemp	-0.243	0.204	0.134	0.353	-0.194
LtUnemp	-0.243	0.202	0.127	0.361	-0.170
Low15	0.023	0.385	0.053	-0.191	0.094
LowKids	0.008	0.381	0.072	-0.181	0.100
AvgHHInc	0.246	-0.201	0.149	0.256	-0.150
HouAff	0.257	0.220	-0.048	-0.045	-0.200
Pop65	0.027	0.147	-0.390	-0.178	0.197
AboPer	-0.161	-0.118	0.376	-0.189	0.019
ImmPer	0.269	0.115	0.166	0.237	0.283
Growth	0.228	-0.181	0.149	0.058	0.059
PostSec	0.282	0.057	-0.031	0.072	-0.368

Appendix C: Cluster Descriptive Statistics

Cluster		Population Density	Percent Aboriginal	Government Transfer Income	Male-Female Ratio	Population Growth	Internal Migrant Mobility
A	N	24	24	24	24	24	24
	Mean	169.1	3.7	13.3	0.95	1.8	16.3
	Std. Dev.	341.5	3.1	1.7	0.02	2.2	3.9
	Minimum	8.6	0.2	10.9	0.91	-1.8	8.2
	Maximum	1388.3	10.7	17.5	0.98	6.8	22.8
B	N	14	14	14	14	14	14
	Mean	351.5	1.6	8.3	0.97	10.9	17.5
	Std. Dev.	354.6	1.3	1.6	0.01	4.7	3.6
	Minimum	4.5	0.4	5.9	0.94	4.4	10.8
	Maximum	1276.5	4.4	10.3	1.00	23.1	23.0
C	N	23	23	23	23	23	23
	Mean	8.8	5.0	16.9	0.97	-2.1	15.2
	Std. Dev.	7.7	6.6	2.0	0.02	2.7	3.6
	Minimum	0.7	0.3	13.2	0.94	-9.2	9.4
	Maximum	28.0	31.4	20.4	1.01	2.6	20.5
D	N	10	10	10	10	10	10
	Mean	2.9	7.5	19.1	0.99	-3.4	15.5
	Std. Dev.	3.1	7.3	3.7	0.02	2.7	1.5
	Minimum	1.0	0.3	14.7	0.96	-6.6	12.0
	Maximum	11.0	24.8	25.4	1.02	2.6	17.0
E	N	25	25	25	25	25	25
	Mean	19.0	5.1	13.4	0.99	3.4	20.2
	Std. Dev.	19.2	6.4	1.6	0.03	3.5	3.6
	Minimum	0.8	0.2	10.1	0.96	-1.2	14.4
	Maximum	77.9	24.0	16.6	1.05	14.3	27.7
F	N	5	5	5	5	5	5
	Mean	0.5	85.6	19.1	1.04	5.3	13.4
	Std. Dev.	1.0	8.9	5.6	0.03	6.5	3.7
	Minimum	0.0	72.2	12.9	1.01	-2.6	8.8
	Maximum	2.3	95.6	25.0	1.07	11.3	18.9
G	N	3	3	3	3	3	3
	Mean	3934.4	0.9	11.0	0.94	4.1	11.4
	Std. Dev.	306.9	0.9	2.5	0.03	2.1	3.8
	Minimum	3625.1	0.3	9.5	0.92	2.1	7.1
	Maximum	4238.8	2.0	13.9	0.97	6.2	14.2
H	N	13	13	13	13	13	13
	Mean	0.5	23.0	11.1	1.04	-3.6	17.0
	Std. Dev.	0.6	13.7	3.2	0.03	6.4	4.7
	Minimum	0.0	2.4	4.8	1.00	-11.0	10.0
	Maximum	2.3	50.5	16.3	1.10	14.9	25.3
I	N	10	10	10	10	10	10
	Mean	7.5	4.0	26.7	0.97	-7.5	9.3
	Std. Dev.	6.2	3.8	2.4	0.03	3.4	1.8
	Minimum	0.3	0.5	23.1	0.91	-11.4	5.6
	Maximum	17.8	13.6	29.6	1.01	-2.0	11.9

Appendix D: Summary of Cluster Assignments

Final Peer Group A		Step 4.2.1	Step 4.3.1	Step 4.3.2	Step 4.3.3	Step 5.3
1001	Health and Community Services St. John's Region	B	C	A	A	A
1103	Queens	B	A	A	A	A
1206	Zone 6	B	A	A	A	A
2403	Région de Québec	B	A	A	A	A
2407	Région de l'Outaouais	B	A	A	A	A
2413	Région de Laval	B	A	A	A	A
2416	Région de la Montérégie	B	A	A	A	A
3527	Brant County Health Unit	B	A	A	A	A
3537	City of Hamilton Health Unit	B	A	A	A	A
3538	Hastings and Prince Edward Counties Health Unit	B	A	A	A	A
3540	Chatham-Kent Health Unit	B	A	A	A	A
3541	Kingston Frontenac and Lennox and Addington Health Unit	B	A	A	A	A
3542	Lambton Health Unit	B	A	A	A	A
3544	Middlesex-London Health Unit	B	A	A	A	A
3546	Niagara Regional Area Health Unit	B	A	A	A	A
3555	Peterborough County-City Health Unit	B	A	A	A	A
4610	Winnipeg	B	A	A	A	A
4615	Brandon	B	A	A	A	A
4704	Regina Qu'Appelle	B	A	A	A	A
4706	Saskatoon	B	A	A	A	A
5913	Okanagan	B	A	A	A	A
5921	Fraser Valley	B	A	A	A	A
5941	South Vancouver Island	L	A	A	A	A
5942	Central Vancouver Island	B	C	A	A	A

Final Peer Group B		Step 4.2.1	Step 4.3.1	Step 4.3.2	Step 4.3.3	Step 5.3
3530	Durham Regional Health Unit	D	B	B	B	B
3536	Halton Regional Health Unit	D	B	B	B	B
3551	City of Ottawa Health Unit	L	B	B	B	B
3553	Peel Regional Health Unit	D	B	B	B	B
3565	Waterloo Health Unit	B	B	B	B	B
3566	Wellington-Dufferin-Guelph Health Unit	B	B	B	B	B
3568	Windsor-Essex County Health Unit	B	B	B	B	B
3570	York Regional Health Unit	D	B	B	B	B
4822	Calgary Health Region	D	B	B	B	B
4825	Capital Health Region	B	B	B	B	B
5922	Simon Fraser	L	B	B	B	B
5923	South Fraser	L	B	B	B	B
5931	Richmond	J	G		B	B
5933	North Shore/Coast Garibaldi	L	B	B	B	B

Final Peer Group C		Step 4.2.1	Step 4.3.1	Step 4.3.2	Step 4.3.3	Step 5.3
1102	East Prince	H	C	C	C	C
1201	Zone 1	H	C	C	C	C
1202	Zone 2	H	C	C	C	C
1203	Zone 3	H	C	C	C	C
1204	Zone 4	Q	C	C	C	C
1301	Region 1	B	C	C	C	C
1302	Region 2	B	C	C	C	C
1303	Region 3	B	C	C	C	C
1304	Region 4	Q	C	C	C	C
2401	Région du Bas-Saint-Laurent	Q	C	C	C	C
2402	Région du Saguenay - Lac-Saint-Jean	B	C	C	C	C
2404	Région de la Mauricie et Centre-du-Québec	B	C	C	C	C
2405	Région de l'Estrie	B	C	C	C	C
2408	Région de l'Abitibi-Témiscamingue	F	C	C	C	C
3526	The District of Algoma Health Unit	H	C	C	C	C
3547	North Bay and District Health Unit	B	C	C	C	C
3561	Sudbury and District Health Unit	B	C	C	C	C
3562	Thunder Bay District Health Unit	B	C	C	C	C
3563	Timiskaming Health Unit	H	C	C	C	C
4709	Prince Albert Parkland	F	C	C	C	C
5912	Kootenay-Boundary	H	C	C	C	C
5914	Thompson/Cariboo	B	C	C	C	C
5943	North Vancouver Island	B	C	C	C	C

Final Peer Group D		Step 4.2.1	Step 4.3.1	Step 4.3.2	Step 4.3.3	Step 5.3
1104	Kings	H	D	D	D	D
4640	Central	H	D	D	D	D
4645	Assiniboine	H	D	D	D	D
4660	Parkland	H	D	D	D	D
4701	Sun Country	H	D	D	D	D
4702	Five Hills	H	D	D	D	D
4703	Cypress	H	D	D	D	D
4705	Sunrise	H	D	D	D	D
4707	Heartland	H	D	D	D	D
4708	Kelsey Trail	H	D	D	D	D

Final Peer Group E		Step 4.2.1	Step 4.3.1	Step 4.3.2	Step 4.3.3	Step 5.3
2412	Région de la Chaudière-Appalaches	H	E	E	E	E
2414	Région de Lanaudière	B	E	E	E	E
2415	Région de Laurentides	B	A	E	E	E
3531	Elgin-St Thomas Health Unit	B	E	E	E	E
3533	Grey Bruce Health Unit	H	E	E	E	E
3534	Haldimand-Norfolk Health Unit	B	E	E	E	E
3535	Haliburton Kawartha Pine Ridge District Health Unit	B	E	E	E	E
3539	Huron County Health Unit	H	E	E	E	E
3543	Leeds Grenville and Lanark District Health Unit	B	E	E	E	E
3545	Muskoka-Parry Sound Health Unit	H	E	E	E	E
3552	Oxford County Health Unit	B	E	E	E	E
3554	Perth District Health Unit	B	E	E	E	E
3557	Renfrew County and District Health Unit	H	E	E	E	E
3558	The Eastern Ontario Health Unit	B	E	E	E	E
3560	Simcoe County District Health Unit	B	E	E	E	E
4620	North Eastman	H	E	E	E	E
4625	South Eastman	H	E	E	E	E
4630	Interlake	H	E	E	E	E
4820	Chinook Regional Health Authority	B	E	E	E	E
4821	Palliser Regional Health Authority	B	E	E	E	E
4823	David Thompson Regional Health Authority	B	E	E	E	E
4824	East Central Regional Health Authority	H	E	E	E	E
4826	Aspen Regional Health Authority	F	E	E	E	E
4827	Mistahia Regional Health Authority	I	E	E	E	E
5911	East Kootenay	H	E	E	E	E

Final Peer Group F		Step 4.2.1	Step 4.3.1	Step 4.3.2	Step 4.3.3	Step 5.3
2417	Région du Nunavik	C	F	F	F	F
2418	Région des Terres-Cries-de-la-Baie-James	G	F		F	F
4685	Burntwood/Churchill	K	F	F	F	F
4714	Mamawetan/Keewatin/Athabasca	K	F		F	F
6201	Nunavut	A	F	F	F	F

Final Peer Group G		Step 4.2.1	Step 4.3.1	Step 4.3.2	Step 4.3.3	Step 5.3
2406	Région de Montréal-Centre	N	G	G	G	G
3595	City of Toronto Health Unit	M	G	G	G	G
5932	Vancouver	O	G	G	G	G

Final Peer Group H		Step 4.2.1	Step 4.3.1	Step 4.3.2	Step 4.3.3	Step 5.3
1006	Health Labrador Corporation	F	J	J	J	H
2409	Région de la Côte-Nord	F	J	J	J	H
2410	Région du Nord-du-Québec	R	J	J	J	H
3549	Northwestern Health Unit	F	J	J	J	H
3556	Porcupine Health Unit	F	J	J	J	H
4670	Norman	F	J	J	J	H
4710	Prairie North	F	C	J	J	H
4828	Northern Lights Regional Health Authority	I	E	H	H	H
5951	North West	F	J	J	J	H
5952	Northern Interior	F	J	J	J	H
5953	Northeast	R	J	J	J	H
6001	Yukon	P	H	H	H	H
6101	Northwest Territories	P	H	H	H	H

Final Peer Group I		Step 4.2.1	Step 4.3.1	Step 4.3.2	Step 4.3.3	Step 5.3
1002	Health and Community Services Eastern Region	Q	I	I	I	I
1003	Health and Community Services Central Region	Q	I	I	I	I
1004	Health and Community Services Western Region	Q	I	I	I	I
1005	Grenfell Regional Health Services Board	E	I		I	I
1101	West Prince	Q	I	I	I	I
1205	Zone 5	Q	I	I	I	I
1305	Region 5	Q	I	I	I	I
1306	Region 6	Q	I	I	I	I
1307	Region 7	Q	I	I	I	I
2411	Région de la Gaspésie - Îles-de-la-Madeleine	Q	I	I	I	I