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ABSTRACT

Objectives:

This article examines the extent of geographic disparity in premature mortality in Ontario and considers factors that may underlie variations in premature mortality across geographic areas.

Data Source:

Mortality data for years 1992-1996 were obtained from Vital Statistics Records, Office of the Registrar General, Ontario Ministry of Consumer and Commercial Relations. Population data for years 1992-1996 were obtained from Statistics Canada inter-censal population estimates (CANSIM database). Data are also presented from the household component of the 1996/97 National Population Health Survey and from the 1996 Statistics Canada Census.

Analytical Techniques:

All-cause, sex and disease chapter specific premature mortality in Ontario were analyzed at the regional, district health council and public health unit level to determine the extent of geographic disparity. We calculated standardized mortality ratios for persons aged 0-74 years to identify geographic areas with significantly higher or lower premature mortality than expected, using Ontario death rates as the basis for the calculation of expected deaths in the local population.

Main Results:

Results showed approximately 20% higher than expected all-cause premature mortality for males and females in the North region. However, disparity in all-cause premature mortality in Ontario was most pronounced at the public health unit level, ranging from 20% lower than expected to 30% higher than expected. Premature mortality disparities were largely influenced by neoplasms, circulatory diseases, injuries and poisoning, respiratory diseases and digestive diseases, which accounted for more than 80% of all premature deaths. Premature mortality disparities were also more pronounced for disease chapter specific mortality. Geographic disparities in premature mortality undoubtedly reflect the underlying distribution of population health determinants such as health related behaviours, social, economic and environmental influences.

Key Words: mortality, cause of death, epidemiology, Ontario

INTRODUCTION

Mortality statistics are an important means of describing and monitoring population health status.^{1,2}

This report describes the extent of geographic disparity in all-cause, sex and disease chapter specific premature mortality in Ontario at the regional, district health council and public health unit level. Analyses of geographic variations in population health status can help to guide policies that address the economic, social and environmental determinants of health, identify needs for health care services and assist health planners to target and prioritize health promotion and disease prevention programs within geographic areas. Our objectives were to examine the extent of geographic disparity in premature mortality and to consider factors that may underlie variations in premature mortality across geographic areas.

METHODS

Mortality data including place of residence and International Classification of Diseases (ICD)-9 chapter of the underlying cause of death for Ontario residents aged 0-74 for years 1992-1996 were obtained from Vital Statistics Records, Office of the Registrar General, Ontario Ministry of Consumer and Commercial Relations. Deaths for all Ontario residents (regardless of where they occurred) were included in the tabulations; deaths of non-Ontario residents that occurred in Ontario were not included. Population data for years 1992-1996 were obtained from Statistics Canada inter-censal population estimates (CANSIM database).

Standardized mortality ratios (SMRs) compare observed deaths in a local population to the deaths expected if the local population has been subject to provincial average death rates for each age group, sex and disease chapter. Expected deaths were based on provincial age group, sex and disease chapter-specific mortality rates. To obtain expected deaths, provincial rates were applied to the seven regional planning areas, 16 district health councils and 37 public health units in Ontario, giving the expected number of deaths in the area if the age and sex-specific provincial

rates were applied to these populations for each disease chapter.³

Standardized mortality ratios were calculated as observed deaths divided by expected deaths by geographic level, sex and disease chapter. An SMR value of one for a geographic area indicates the same mortality rate as for the whole of Ontario after accounting for differences between the age distribution of the population of the geographic area and the Ontario population. For example, an SMR of 1.08 indicates that the region experienced mortality 8% higher than expected. Similarly, an SMR of 0.92 indicates that the region experienced mortality 8% lower than expected.

Aggregation of deaths over the five-year period 1992-1996 reduced the impact of year-to-year fluctuations. This was especially important when analyzing less populous geographic areas, as annual mortality rates calculated from small numbers of observed deaths can vary substantially from one year to the next. Ninety-five percent confidence intervals on SMRs were calculated.⁴ In most cases the SMRs were based on very large numbers of expected and observed deaths leading to very narrow confidence intervals.

Although no single relative mortality measure is preferable for all purposes, premature mortality (death between birth and age 75) was selected to focus on potentially preventable deaths,^{5,6} given an Ontario average life expectancy of 78.9 years in 1996.⁷ Analyses of geographical variation for all-age mortality have elderly deaths that contribute substantially.⁸

Standardized mortality ratios were used to examine and focus on opportunities to *reduce geographic disparity in premature mortality* within the determinants of health framework. Alternatively, if the objective of the study is to examine and focus on opportunities to reduce premature mortality *as a loss to society*, potential years of life lost prior to age 75 may be a better measure (i.e., deaths at earlier ages result in greater losses to society compared to deaths nearer to the cut-off age).⁹

RESULTS

Table 1 presents all-cause SMRs for Ontario planning regions, district health councils and public health units from 1992-1996. Results from this table will be discussed below by region. Table 2 shows Ontario average annual premature mortality rates per 100,000 by ICD-9 chapter, total number of premature deaths and the percentage of total premature deaths attributable to each disease chapter from 1992-1996. Information in this table is required to understand the impact of variations in disease chapter SMRs on variation in total premature mortality. Neoplasms and circulatory system diseases were the dominant causes of premature mortality among Ontarians aged 0-74. These two disease chapters accounted for 64% and 69% of all premature deaths among males and females respectively. Injuries and poisonings, respiratory system diseases, and digestive system diseases accounted for an additional 19% (males) and 15% (females). Overall, the five leading disease chapters accounted for over 80% of all premature deaths. Tables 3a and 3b present SMRs for males and females by disease chapter at the public health unit level.

South West Region

The South West region had higher than expected all-cause premature mortality, with SMRs of 1.07 (95% CI 1.0711-1.0714) for males and 1.06 (95% CI 1.059-1.060) for females. High SMRs of 1.12 (95% CI 1.119-1.120) for males and 1.11 (95% CI 1.106-1.108) for females in Essex-Kent-Lambton (district health council) contributed to high regional SMRs. At the public health unit level, Chatham-Kent had the highest all-cause SMRs of 1.26 (95% CI 1.255-1.259) for males and 1.29 (95% CI 1.289-1.296) for females, which contrasted with other South West public health unit areas whose SMRs ranged from 0.95 to 1.12. Windsor-Essex and Elgin-St. Thomas also had substantially elevated all-cause SMRs: 1.10 and 1.12 for males and 1.10 and 1.07 for females, respectively.

Chatham-Kent had particularly high SMRs for circulatory system diseases (1.44 for males and 1.50 for females), but SMRs were also elevated for the other leading causes of premature mortality:

neoplasms, injuries and poisonings, respiratory system diseases and digestive system diseases. Endocrine, nutritional and metabolic diseases and immunity disorders SMRs were substantially higher than expected in Elgin-St.Thomas and in Chatham-Kent among females.

Central South Region

The Central South region also had higher than expected all-cause premature mortality, with SMRs of 1.06 (95% CI 1.0561-1.0564) for males and 1.07 (95% CI 1.0678-1.0683) for females. High SMRs of 1.10 (95% CI 1.103-1.104) for males and 1.12 (95% CI 1.115-1.118) for females in Grand River (district health council) contributed to high regional SMRs. Public health unit area SMRs ranged from 1.03 (95% CI 1.026-1.027) for males and 1.04 (95% CI 1.039-1.040) for females in Niagara to 1.13 (95% CI 1.126-1.130) for males and 1.14 (95% CI 1.140-1.146) for females in Brant, demonstrating greater geographic disparity than at the regional and district health council levels.

Brant had high SMRs for all five leading disease category causes of premature death. SMRs were particularly high (greater than 1.20) for both males and females for circulatory system, respiratory system and digestive system diseases and for injuries and poisonings in males. Haldimand-Norfolk also had substantially elevated SMRs for circulatory system diseases: 1.26 and 1.21 for males and females, respectively.

Central West Region

The Central West region demonstrated the lowest all-cause premature mortality with SMRs of 0.85 (95% CI 0.8511-0.8513) for males and 0.89 (95% CI 0.8910-0.8913) for females. District health council area SMRs ranged from 0.79 (95% CI 0.7896-0.7899) for males and 0.84 (95% CI 0.844-0.845) for females in Halton-Peel to 0.96 (95% CI 0.9588-0.9595) for males and 0.97 (95% CI 0.970-0.971) for females in Waterloo Region-Wellington-Dufferin. Standardized mortality ratios at

the public health unit level were similar to those at the district health council level.

With the exception of neoplasms among females in Halton, Halton and Peel public health unit SMRs were among the lowest in the province for neoplasms, circulatory system diseases, injuries and poisonings, respiratory system diseases, and digestive system diseases.

Toronto

Toronto had similar all-cause premature mortality to the province for males with an SMR of 0.99 (95% CI 0.9887-0.9888) and lower than expected premature mortality for females with an SMR of 0.92 (95% CI 0.9199-0.9201). Standardized mortality ratios were calculated at the former public health unit level (i.e., East York, Etobicoke, North York, Scarborough, Toronto City and York City) and large geographic disparities in all-cause premature mortality were observed. However, place of residence miscoding is a significant source of error in calculating vital statistics measures for former public health units in Toronto¹⁰ (personal communication, F. Goettler, 2002); therefore, the data are not presented.

With the exception of digestive system diseases among males, Toronto SMRs were lower than expected for all of the leading causes of premature deaths: neoplasms, circulatory system diseases, injuries and poisonings, respiratory system diseases, and digestive system diseases. However, infectious and parasitic disease SMRs were substantially higher than expected in Toronto among both sexes (especially among males).

Central East Region

The Central East region had lower than expected all-cause premature mortality with SMRs of 0.92 (95% CI 0.9186-0.9188) for males and 0.96 (95% CI 0.9639-0.9643) for females. At the public health unit level, York's SMRs of 0.78 (95% CI 0.7776-0.7782) for males and 0.87 (95% CI 0.870-

0.871) for females contrasted with Simcoe's SMRs of 1.05 (95% CI 1.051-1.052) for males and 1.05 (95% CI 1.045-1.047) for females, demonstrating greater geographic disparity in premature mortality at the small area level.

Similar to Halton and Peel public health units, York also demonstrated SMRs among the lowest in the province for neoplasms, circulatory system diseases, injuries and poisonings, respiratory system diseases, and digestive system diseases.

East Region

The East region all-cause premature mortality was similar to the province for males, with an SMR of 1.01 (95% CI 1.008-1.009), and higher than expected for females, with an SMR of 1.05 (95% CI 1.0479-1.0484). However, geographic disparity in premature mortality at the public health unit level revealed SMRs ranging from 0.88 (95% CI 0.883-0.884) for males and 0.95 (95% CI 0.9465-0.9474) for females in Ottawa-Carleton to 1.17 (95% CI 1.169-1.171) for males and 1.20 (95% CI 1.203-1.207) for females in Hastings-Prince Edward. All-cause SMRs were also substantially higher than expected for Leeds-Grenville-Lanark and Eastern Ontario public health unit areas.

Ottawa-Carleton had low SMRs for circulatory system diseases, injuries and poisonings, and respiratory system diseases for both males and females. Conversely, Hastings-Prince Edward and Leeds-Grenville-Lanark had high SMRs in each of the five leading disease chapters for both males and females. Eastern Ontario public health unit also had high SMRs for both males and females for neoplasms, circulatory system diseases, injuries and poisonings, and respiratory system diseases.

North Region

The North region had the highest SMRs, indicating approximately 20% greater than expected all-cause premature mortality relative to the province; 1.21 (95% CI 1.2105-1.2110) for males and 1.20 (95% CI 1.1956-1.1964) for females. All public health unit areas within the North region, except for

Muskoka-Parry Sound, had substantially higher than expected premature mortality, ranging from 14% to 32% higher among males and 17% to 31% higher among females. Public health unit level all-cause SMRs were highest for Northwestern (1.28 for males and 1.27 for females) and Porcupine (1.32 for males and 1.25 for females).

All public health unit areas except Muskoka-Parry Sound and Thunder Bay had high neoplasm SMRs for both males and females. Circulatory system SMRs were also elevated for all public health unit areas for both males and females except Muskoka-Parry Sound and Northwestern. Respiratory system SMRs were elevated for all public health unit areas except Thunder Bay and Northwestern. Standardized mortality ratios for injuries and poisonings were substantially higher than expected in all public health units, ranging from 1.34 to 3.17 for males and 1.23 to 3.58 for females. Because neoplasms and circulatory system diseases together account for approximately two-thirds of all deaths, high SMRs in these disease categories account for most of the higher all-cause SMRs in the North region.

DISCUSSION

There were significant disparities in the risk of premature mortality among geographic areas in Ontario during the period 1992-1996. The North region demonstrated approximately 20% higher than expected all-cause premature mortality among both sexes relative to the province. Some public health unit areas in the North had greater than 25% higher expected premature mortality. South West, Central South and East regions had higher than expected premature mortality at the regional level; however, there was significant variation at the district health council and public health unit level. Central West, Toronto and Central East all had lower than expected premature mortality. However, despite lower than expected all-cause premature mortality at the regional level, substantial disparities existed at the public health unit level. Other studies have also indicated large differences in measures of premature mortality at the local level in Ontario and widening disparity in

premature mortality rates at the regional level in Manitoba.^{11,12,13} These geographic disparities in premature mortality undoubtedly reflect the underlying distribution of population health determinants such as health related behaviours, and social, economic and environmental influences.

High neoplasm SMRs were common among public health units in the North region. Tobacco use as a risk factor has been suggested to account for the majority of cancer deaths.¹⁴ Data from the 1996/97 National Population Health Survey indicated that the prevalence of regular smoking was significantly higher than the provincial rate among all North Region health areas, which may contribute to high neoplasm SMRs revealed in the present study (Table 4).¹⁵ However, due to the lag time required to develop cancer, this potential association assumes that a higher smoking rate is not a new phenomenon, but a characteristic of the resident population over time. Health areas in the South West (Essex), Central South (Brant, Haldimand-Norfolk), and East (Hastings-Prince Edward and Leeds-Grenville-Lanark) also demonstrated smoking prevalence rates which were greater than the provincial average, potentially leading to higher than expected neoplasm SMRs. However, other important risk factors for neoplasm SMRs must be considered, such as diet, occupation, family history and alcohol.¹⁴ Furthermore, research in Ontario has also shown significant associations between high neoplasm SMRs for males and decreased environmental protection expenditures, which remained significant after controlling for conventional risk factors such as smoking.¹⁶

High circulatory system disease SMRs were common in South West, Central South, East and North region public health units. Conditions or risk factors associated with circulatory system disease deaths include hypertension, diabetes, smoking, high body mass index, inactivity and high stress. Data from the 1996/97 National Population Health Survey (Table 4)¹⁵ and the 1990 Ontario Health Survey indicate that prevalence rates for many of these conditions were higher than provincial averages in Kent-Lambton, Eastern Ontario and in Northern Ontario.¹⁷ High circulatory system disease SMRs in the areas identified in the present study may be related to higher prevalence of

these conditions or risk factors.

High respiratory system disease SMRs were common in the South West, East and North region public health units. Data from the 1996/97 National Population Health Survey indicated that the prevalence of regular smoking was significantly higher than the provincial rate among all North region public health units which may contribute to high respiratory system disease SMRs. Prevalence of regular smoking was also significantly higher in Essex; Brant, Haldimand-Norfolk; and Hastings-Prince Edward and Leeds-Grenville-Lanark. High respiratory system disease SMRs may be related to higher prevalence of smoking in these areas.

Conventional risk factors such as smoking and low physical activity may be related to observed premature mortality for neoplasms, circulatory and respiratory system diseases. However, determinants of health also include factors such as social class, income and education.¹⁸ Geographic distribution of these social and economic determinants of health may also influence premature mortality in Ontario. For example, a comparative analysis of ten Ontario regional municipalities examined a variety of indicators including work hierarchy and organization, unemployment, social networks, health choices and social rank.¹⁹ Municipalities whose indicators were consistently lower than average (Hamilton-Wentworth, Niagara, and Sudbury) demonstrated high SMRs in the current research. Municipalities with determinants of health indicators consistently higher than average (Halton and York) demonstrated low SMRs in the current research. Current results also indicated public health units with the highest SMRs (North region) had higher than provincial rates of unemployment, economic families classified as low income, and residents aged 15+ with less than grade 9 education (Table 4).²⁰ Conversely, public health units with the lowest SMRs (Halton, Peel and York) had lower than provincial rates of unemployment, economic families classified as low income, and residents aged 15+ with less than grade 9 education. Previous research in Ontario has shown education to be an important variable in

understanding premature mortality.¹⁶ This could be a direct effect of greater knowledge of potential health threats, or mediated through higher income, allowing better nutrition and housing. Although figures on unemployment, education and income represent data from the 1996 Census, it is important to note that social and economic determinants influence health over a lifetime.

LIMITATIONS

Standardized mortality ratio ranges widened from region to district health council to public health unit (more so for disease chapter specific than all-cause SMRs), indicating greater geographic variation in premature mortality at the public health unit level. However, a portion of the SMR variability for smaller geographic areas may be attributable to smaller numbers of observed deaths resulting in less stable SMRs. Greater variability in the range of SMR values observed at the level of the public health unit compared to the region or district health council level is also attributable to the larger number of public health units compared to regions or district health councils.

Although death certificate diagnoses and coding practices may lead to classification errors, virtually all deaths are registered to comply with reporting requirements^{21,22} (incomplete death registration has been noted in certain areas of Ontario).²³ Even though all-cause mortality is not influenced by diagnosis coding errors, assuming complete death registration, systematic variation in underlying cause of death reporting practices among geographic areas could bias the results of disease chapter specific analyses. Similarly, misclassifying the place of residence on death certificates could also bias results.²⁴

CONCLUSION

Significant disparities in the risk of premature mortality among geographic areas exist in Ontario. This research has examined the extent of geographic premature mortality disparity and considered various determinants of health which may underlie observed variation. Knowledge of conventional

risk factors such as smoking coupled with other determinants of health such as environment, education and social hierarchy are all important to understand health inequalities. Although no simple policy prescription is evident from the results, analyses of geographic variation in premature mortality help generate hypotheses for future research in order to gain a better understanding of determinants of health. Only then, can a complex of health care, social and economic policies that aim to reduce premature mortality disparity in Ontario be developed. Clearly, an appropriate policy response to premature mortality disparity in Ontario would need to extend well beyond the public financing of health care to address the wide range of determinants of health that are outside the reach of the health care system.

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Table 1: All-cause standardized mortality ratios for Ontario by planning region, district health council and public health unit, ages 0-74, 1992-1996*

Planning Region	District Health Council		Public Health Unit							
	Males	Females	Males	Females						
South West	1.07	1.06	Essex-Kent-Lambton	Windsor-Essex	1.12	1.11	1.10	1.10		
				Chatham-Kent	1.26	1.29				
				Lambton	1.05	0.97				
			Thames Valley	1.06	1.03	Middlesex-London	1.06	1.02	1.06	1.02
						Elgin-St. Thomas	1.12	1.07		
						Oxford	1.05	1.04		
			Grey-Bruce-Huron-Perth	0.99	1.02	Grey-Bruce-Owen Sound	1.01	1.04	1.01	1.04
						Huron	0.95	1.00		
						Perth	0.98	0.97		
Central South	1.06	1.07	Grand River	Brant	1.10	1.12	1.13	1.14		
				Haldimand-Norfolk	1.08	1.09				
			Hamilton Niagara	1.06 1.03	1.07 1.04	Hamilton	1.06	1.07	1.06	1.07
						Niagara	1.03	1.04	1.03	1.04
Central West	0.85	0.89	Halton-Peel	Halton	0.79	0.84	0.79	0.87		
				Peel	0.79	0.83				
			Waterloo Region Wellington-Dufferin	0.96 0.96	0.97 0.98	Waterloo	0.96	0.96	0.96	0.96
						Wellington-Dufferin-Guelph	0.96	0.98		
Toronto	0.99	0.92	Toronto	0.99	0.92	Toronto	0.99	0.92		
Central East	0.92	0.96	Simcoe-York	Simcoe	0.89	0.94	1.05	1.05		
				York	0.78	0.87				
			Durham-Haliburton Kawartha-Pine Ridge	0.95	0.99	Durham	0.90	0.98	0.90	0.98
						Haliburton-Kawartha Pine Ridge	0.98	0.96		
						Peterborough	1.04	1.03		
East	1.01	1.05	Champlain	Ottawa-Carleton	0.96	0.999	0.88	0.95		
				Renfrew	1.08	1.08				
				Eastern Ontario	1.14	1.14				
			Southeastern Ontario	1.10	1.14	Kingston-Frontenac-Lennox-Addington	1.03	1.06	1.03	1.06
						Hastings-Prince Edward	1.17	1.20		
						Leeds-Grenville-Lanark	1.12	1.16		
North	1.21	1.20	Algoma-Cochrane-Manitoulin-Sudbury	Algoma	1.25	1.23	1.18	1.21		
				Porcupine	1.32	1.25				
				Sudbury	1.27	1.24				
			Muskoka-Nipissing-Parry Sound-Timiskaming	1.16	1.13	Muskoka-Parry Sound	1.06	1.01	1.06	1.01
						North Bay	1.27	1.20		
						Timiskaming	1.23	1.31		
			Northwestern	1.19	1.20	Thunder Bay	1.14	1.17	1.14	1.17
						Northwestern	1.28	1.27		

Data source: Vital Statistics Records, Office of the Registrar General, Ontario Ministry of Consumer and Commercial Relations

Notes:

* All standardized mortality ratios are statistically different from 1.00 ($p < 0.05$) except the female Huron SMR

Table 2: Ontario average annual mortality rates per 100,000, total number of deaths and percent of total deaths attributable to disease chapters, ages 0-74, 1992-1996

Disease Chapter (ICD-9)	Males			Females		
	Rate	# of deaths (1992-96)	Percent of deaths	Rate	# of deaths (1992-96)	Percent of deaths
Infectious and Parasitic Diseases	14.22	3,708	3.45	3.45	901	1.34
Neoplasms	137.11	35,751	33.27	114.11	29,714	44.33
Endocrine, Nutritional and Metabolic Diseases and Immunity Disorders	12.62	3,293	3.06	9.04	2,350	3.51
Diseases of Blood and Blood-Forming Organs	1.00	261	0.24	0.87	225	0.34
Mental Disorders	5.20	1,356	1.26	2.25	587	0.88
Diseases of the Nervous System and Sense Organs	8.13	2,123	1.98	6.81	1,775	2.65
Diseases of the Circulatory System	127.78	33,288	30.98	63.93	16,626	24.80
Diseases of the Respiratory System	21.60	5,632	5.24	14.10	3,673	5.48
Diseases of the Digestive System	17.34	4,522	4.21	9.37	2,437	3.64
Diseases of the Genitourinary System	3.87	1,010	0.94	2.90	754	1.12
Complications of Pregnancy, Childbirth and Puerperium	0.18	47	0.07
Diseases of the Skin and Subcutaneous Tissue	0.20	52	0.05	0.15	40	0.06
Diseases of the Musculoskeletal System and Connective Tissue	0.94	244	0.23	1.65	429	0.64
Congenital Anomalies	4.04	1,053	0.98	3.51	915	1.37
Certain Conditions Originating in the Perinatal Period	4.40	1,147	1.07	3.07	798	1.19
Symptoms, Signs and Ill-Defined Conditions	13.59	3,544	3.30	6.82	1,776	2.65
Injury and Poisoning	40.25	10,482	9.75	15.32	3,985	5.94
All Causes	412.28	107,466	100.00	257.53	67,032	100.00

Data source: Vital Statistics Records, Office of the Registrar General, Ontario Ministry of Consumer and Commercial Relations

Notes:

... Figures not applicable

TABLE 3a: Disease chapter standardized mortality ratios for males in Ontario by public health unit, ages 0-74, 1992-1996

Public Health Unit	Inf.	Neo.	End.	Blo.	Men.	Ner.	Cir.	Res.	Dig.	Gen.	Ski.Mus.	Con.	Per.	Sym.	Inj.	All.†	
Windsor-Essex	0.93*	1.13*	1.07*	0.82	0.88*	1.14*	1.16*	0.98*	1.15*	1.02	--	1.25	1.02	0.97	0.74*	1.10*	1.10*
Chatham-Kent	0.53*	1.16*	1.07*	1.78	0.96	1.40*	1.44*	1.26*	1.24*	1.63*	--	--	0.94	1.14	0.90*	1.41*	1.26*
Lambton	0.42*	1.11*	1.09*	--	0.71*	0.91*	1.11*	1.13*	0.94*	1.00	--	--	0.96	0.75*	0.53*	1.13*	1.05*
Middlesex-London	1.14*	1.03*	1.13*	1.64*	1.52*	1.03*	1.06*	1.11*	1.00	1.28*	--	0.82	1.04	0.99	0.88*	1.04*	1.06*
Elgin-St. Thomas	0.42*	1.18*	1.56*	--	0.88	1.36*	1.12*	1.27*	0.67*	0.64*	--	--	1.59*	0.88	0.27*	1.48*	1.12*
Oxford	0.66*	1.12*	0.98	--	1.08	1.27*	1.02*	1.22*	0.98	0.51*	--	--	1.10	1.18	0.40*	1.17*	1.05*
Grey-Bruce-Owen Sound	0.63*	0.99*	1.09*	--	0.73*	1.10*	1.08*	1.01	0.79*	0.77*	--	--	0.95	0.70*	0.73*	1.28*	1.01*
Huron	0.30*	1.02*	0.85*	--	0.67*	0.70*	0.99	1.00	0.47*	0.70*	--	--	--	--	0.43*	1.37*	0.95*
Perth	0.79*	0.85*	0.92*	--	1.40*	1.08	1.11*	1.20*	0.87*	--	--	--	1.18	--	0.50*	1.26*	0.98*
Brant	0.47*	1.06*	1.23*	--	1.97*	1.04	1.21*	1.26*	1.21*	0.69*	--	2.17	1.36*	0.70*	0.80*	1.23*	1.13*
Haldimand-Norfolk	0.36*	1.04*	0.63*	--	0.70*	1.17*	1.26*	0.79*	0.95*	0.55*	--	--	0.71*	1.24*	0.68*	1.48*	1.08*
Hamilton	0.79*	1.06*	1.12*	0.82*	0.91*	1.29*	1.09*	1.02*	1.27*	1.02	--	2.09*	0.95*	1.14*	1.03*	0.96*	1.06*
Niagara	0.58*	1.05*	1.13*	1.76*	0.75*	0.90*	1.10*	0.94*	1.14*	0.61*	--	0.55*	1.16*	0.62*	0.77*	1.00	1.03*
Halton	0.45*	0.95*	0.63*	--	0.45*	0.87*	0.78*	0.74*	0.73*	0.75*	--	0.80	0.57*	0.95	0.35*	0.73*	0.79*
Peel	0.48*	0.88*	0.86*	0.56*	0.72*	0.92*	0.79*	0.66*	0.75*	0.73*	--	0.56*	0.76*	0.99	0.58*	0.73*	0.79*
Waterloo	0.55*	1.02*	0.77*	1.01	0.65*	1.12*	1.04*	1.09*	0.93*	0.90*	--	0.98	1.26*	0.64*	0.52*	0.83*	0.96*
Wellington-Dufferin-Guelph	0.49*	1.02*	0.63*	1.01	0.86*	1.14*	1.00	0.96*	1.02	0.64*	--	1.10	0.77*	0.93	0.42*	1.12*	0.96*
Toronto	2.40*	0.92*	1.11*	1.07*	1.22*	0.92*	0.86*	0.91*	1.08*	1.25*	1.44*	0.93*	1.09*	1.43*	1.67*	0.79*	0.99*
Simcoe	0.52*	1.07*	1.06*	0.62*	0.88*	0.88*	1.14*	1.21*	1.05*	0.91*	--	0.65*	1.02	0.65*	0.72*	1.04*	1.05*
York	0.45*	0.89*	0.85*	--	0.69*	1.00	0.72*	0.82*	0.59*	0.95*	--	0.74*	0.77*	0.81*	1.14*	0.61*	0.78*
Durham	0.50*	0.98*	1.08*	1.07	1.19*	0.72*	0.88*	0.97*	0.87*	0.88*	--	0.59*	1.01	0.70*	1.31*	0.72*	0.90*
Haliburton-Kawartha-Pine Ridge	0.34*	0.99*	0.76*	1.55	0.71*	0.67*	0.99*	1.06*	1.02	0.84*	--	0.99	0.87*	0.98	1.27*	1.16*	0.98*
Peterborough	0.78*	1.10*	0.93*	1.67	0.97	1.10*	1.02*	0.92*	0.82*	0.88*	--	--	0.44*	1.18	1.16*	1.15*	1.04*
Ottawa-Carleton	0.98*	0.89*	0.80*	1.29*	1.01	0.96*	0.88*	0.86*	1.04*	1.05*	--	1.01	1.00	1.00	0.64*	0.81*	0.88*
Renfrew	0.23*	0.96*	0.80*	--	0.95	1.02	1.31*	0.96*	0.83*	0.85	--	1.98	1.38*	0.90	0.74*	1.46*	1.08*
Eastern Ontario	0.45*	1.12*	0.88*	--	1.01	0.88*	1.30*	1.39*	0.86*	0.90*	--	1.40	0.89*	0.89*	0.77*	1.27*	1.14*
Kingston-Frontenac-Lennox-Addington	0.59*	1.05*	0.67*	--	0.95	1.07*	1.07*	1.03*	0.93*	0.74*	--	--	0.49*	1.08	1.23*	1.16*	1.03*
Hastings-Prince Edward	0.66*	1.07*	0.87*	1.19	0.88*	1.24*	1.28*	1.20*	1.27*	0.94	--	--	1.43*	1.15	1.14*	1.43*	1.17*
Leeds-Grenville-Lanark	0.53*	1.06*	1.04	--	1.79*	1.70*	1.14*	1.36*	1.10*	1.04	--	--	1.21*	0.81*	0.74*	1.26*	1.12*
Algoma	0.45*	1.19*	0.94*	1.44	0.66*	0.67*	1.27*	1.34*	1.21*	1.16	--	--	1.53*	0.68*	1.07*	1.34*	1.18*
Porcupine	0.40*	1.30*	1.28*	2.30	1.06	1.18*	1.30*	1.43*	1.16*	1.95*	--	--	0.52*	0.85	1.20*	1.99*	1.32*
Sudbury	0.49*	1.21*	0.80*	--	1.01	0.96	1.37*	1.29*	1.21*	1.06	--	1.45	1.11	1.11*	0.84*	1.87*	1.27*
Muskoka-Parry Sound	0.40*	0.99*	1.47*	--	0.97	0.88*	1.02*	1.26*	1.03	1.21*	--	--	1.82*	--	0.96	1.63*	1.06*
North Bay	0.48*	1.23*	1.38*	--	1.60*	1.65*	1.31*	1.31*	1.18*	1.67*	--	--	1.33*	--	0.76*	1.62*	1.27*
Timiskaming	0.68*	1.09*	0.90	--	1.65*	1.18	1.27*	1.73*	0.92	1.69	--	--	2.12*	--	1.04	1.66*	1.23*
Thunder Bay	0.33*	0.97*	1.45*	--	1.19*	0.97	1.23*	1.15*	1.27*	1.27*	--	2.10*	1.31*	1.55*	0.61*	1.69*	1.14*
Northwestern	0.31*	1.09*	1.69*	--	1.15	1.08	1.09*	1.34*	0.89*	--	--	--	0.59*	--	1.40*	3.17*	1.28*

Data source: Vital Statistics Records, Office of the Registrar General, Ontario Ministry of Consumer and Commercial Relations

Notes:

Inf.: Infectious and Parasitic Diseases; **Neo.:** Neoplasms; **End.:** Endocrine, Nutritional and Metabolic Diseases and Immunity Disorders; **Blo.:** Diseases of Blood and Blood-Forming Organs; **Men.:** Mental Disorders; **Ner.:** Diseases of the Nervous System and Sense Organs; **Cir.:** Diseases of the Circulatory System; **Res.:** Diseases of the Respiratory System; **Dig.:** Diseases of the Digestive System; **Gen.:** Diseases of the Genitourinary System; **Ski.:** Diseases of the Skin and Subcutaneous Tissue; **Mus.:** Diseases of the Musculoskeletal System and Connective Tissue; **Con.:** Congenital Anomalies; **Per.:** Certain Conditions Originating in the Perinatal Period; **Sym.:** Symptoms, Signs and Ill-Defined Conditions; **Inj.:** Injury and Poisoning; **All.:** All Causes

* Statistically significantly different from 1.00 ($p < 0.05$)

-- Indicates too few deaths to calculate a reliable SMR (less than five observed deaths)

TABLE 3b: Disease chapter standardized mortality ratios for females in Ontario by public health unit, ages 0-74, 1992-1996

Public Health Unit	Inf.	Neo.	End.	Blo.	Men.	Ner.	Cir.	Res.	Dig.	Gen.	Pre.	Ski.Mus.	Con.	Per.	Sym.	Inj.	All.†		
Windsor-Essex	1.01	1.09*	1.02	0.80	0.66*	1.21*	1.18*	0.98*	1.33*	0.74*	--	--	1.12	0.96	0.92*	0.88*	1.14*	1.10*	
Chatham-Kent	0.82*	1.17*	1.93*	--	1.53*	1.32*	1.50*	1.22*	1.22*	2.11*	--	--	1.48	1.47*	0.85	0.63*	1.25*	1.29*	
Lambton	0.77*	0.95*	1.04	2.01	1.02	1.05	1.07*	1.05*	0.82*	1.17	--	--	--	1.64*	0.75*	0.53*	0.66*	0.97*	
Middlesex-London	1.53*	1.04*	0.93*	0.61*	1.37*	1.15*	0.97*	0.94*	1.04*	1.25*	--	--	0.58*	1.06*	1.18*	0.84*	1.04*	1.02*	
Elgin-St. Thomas	--	0.99*	1.88*	--	1.78*	0.66*	1.12*	1.26*	1.13*	--	--	--	2.47	1.50*	1.05	--	1.17*	1.07*	
Oxford	0.82	0.94*	1.05	--	2.30*	1.29*	1.07*	1.10*	1.45*	1.08	--	--	1.47	1.42*	1.21	0.49*	1.11*	1.04*	
Grey-Bruce-Owen Sound	0.77*	1.03*	1.01	--	1.33*	0.89*	1.08*	1.21*	0.93*	1.40*	--	--	1.56*	0.81*	0.87	0.71*	1.00	1.04*	
Huron	--	1.02*	0.64*	--	--	1.22*	1.16*	0.72*	0.76*	--	--	--	--	1.00	--	0.86	1.31*	1.00	
Perth	0.97	0.95*	1.14*	3.18	1.22	0.97	0.98*	1.03	1.18*	0.93	--	--	--	0.78	--	0.91	0.91*	0.97*	
Brant	0.68*	1.13*	0.73*	--	0.89	1.32*	1.24*	1.39*	1.29*	1.14	--	--	1.64	1.42*	0.85	0.90*	0.90*	1.14*	
Haldimand-Norfolk	1.45*	1.03*	0.78*	--	0.84	0.94	1.21*	1.05	1.04	1.29	--	--	--	1.04	1.22	0.58*	1.51*	1.09*	
Hamilton	1.34*	1.05*	0.91*	0.57*	0.83*	1.10*	1.11*	0.98*	1.16*	1.35*	--	--	0.99	1.19*	1.08*	1.18*	1.08*	1.07*	
Niagara	0.75*	1.05*	1.03*	1.41*	0.87*	0.97*	1.05*	0.98*	1.23*	0.66*	--	--	0.89*	1.17*	1.00	0.99	1.03*	1.04*	
Halton	0.62*	1.04*	0.57*	0.74*	1.02	0.88*	0.78*	0.71*	0.86*	0.90*	--	--	0.62*	0.84*	0.80*	0.38*	0.67*	0.87*	
Peel	0.86*	0.88*	0.94*	1.04	0.65*	0.67*	0.80*	0.71*	0.80*	1.00	--	--	0.82*	0.78*	1.08*	0.53*	0.77*	0.83*	
Waterloo	0.86*	0.98*	0.99	0.78*	0.75*	1.00	1.02*	1.01	0.95*	0.79*	--	--	1.10	0.87*	0.71*	0.74*	0.86*	0.96*	
Wellington-Dufferin-Guelph	1.13	1.06*	0.70*	--	1.12	1.19*	0.98*	0.93*	0.77*	0.88	--	--	--	1.23*	0.65*	0.59*	0.95*	0.98*	
Toronto	1.37*	0.91*	0.99*	1.05*	0.85*	0.89*	0.84*	0.84*	0.93*	0.97*	0.81*	0.74*	0.90*	0.98*	1.43*	1.57*	0.88*	0.92*	
Simcoe	0.73*	1.05*	1.06*	1.59*	0.44*	1.03	1.11*	1.01	1.06*	0.94	--	--	1.46*	1.02	0.45*	0.79*	1.15*	1.05*	
York	0.74*	0.94*	0.82*	0.82*	0.64*	1.13*	0.80*	0.87*	0.67*	0.79*	--	--	0.75*	0.60*	0.86*	1.06*	0.73*	0.87*	
Durham	0.66*	1.01*	0.88*	1.13	1.73*	1.08*	0.96*	1.24*	0.97*	0.95	2.39	--	--	1.21*	0.69*	0.59*	1.10*	0.78*	0.98*
Haliburton-Kawartha-Pine Ridge	0.98	0.95*	0.82*	1.88*	1.06	0.80*	1.02*	1.01	0.91*	0.73*	--	--	0.86	0.91	0.64*	1.06	0.87*	0.96*	
Peterborough	0.90	1.09*	0.85*	--	1.55*	1.00	0.96*	1.08*	0.78*	1.35*	--	--	1.16	1.16	--	1.15*	1.08*	1.03*	
Ottawa-Carleton	0.88*	0.99*	0.88*	0.76*	0.77*	0.96*	0.90*	0.94*	0.96*	1.02	--	--	1.12*	1.05*	1.06*	0.68*	0.88*	0.95*	
Renfrew	1.04	1.03*	1.12*	--	0.87	0.81*	1.15*	1.25*	1.42*	1.20	--	--	1.44	0.73*	--	0.85*	1.21*	1.08*	
Eastern Ontario	0.90	1.10*	1.20*	1.28	1.67*	1.10*	1.27*	1.20*	0.97	0.84*	--	--	0.81	0.91	0.68*	0.88*	1.32*	1.14*	
Kingston-Frontenac-Lennox-Addington	0.85*	0.98*	0.96	--	0.79*	1.51*	1.15*	1.37*	0.93*	1.14	--	--	0.95	1.21*	1.34*	0.95	1.01	1.06*	
Hastings-Prince Edward	0.80*	1.20*	1.19*	--	1.18	1.04	1.22*	1.49*	1.16*	0.82*	--	--	1.04	1.56*	0.88	1.00	1.37*	1.20*	
Leeds-Grenville-Lanark	0.84*	1.20*	1.05*	--	1.87*	0.80*	1.07*	1.48*	1.18*	0.95	--	--	1.44*	1.31*	1.17	0.70*	1.34*	1.16*	
Algoma	0.90	1.15*	1.38*	--	1.77*	0.90*	1.27*	1.40*	1.39*	0.95	--	--	--	1.70*	1.12	1.15*	1.23*	1.21*	
Porcupine	0.70*	1.09*	1.21*	--	2.20*	0.93	1.40*	1.57*	1.27*	1.91*	--	--	--	1.10	--	0.96	1.84*	1.25*	
Sudbury	0.59*	1.06*	1.38*	1.42	1.09	1.16*	1.56*	1.50*	0.97	1.35*	--	--	1.35*	0.84*	1.28*	0.84*	1.57*	1.24*	
Muskoka-Parry Sound	0.76*	0.96*	0.72*	--	0.78	1.26*	1.10*	1.07*	0.81*	0.82	--	--	1.07	0.84	1.22	1.00	1.22*	1.01*	
North Bay	--	1.16*	1.67*	--	1.42	1.55*	1.19*	1.52*	0.78*	1.11	--	--	--	1.29	--	0.90	1.53*	1.20*	
Timiskaming	--	1.29*	1.74*	5.76	--	1.45*	1.23*	1.65*	1.16	--	--	--	--	1.59	--	1.22	1.45*	1.31*	
Thunder Bay	1.05	1.06*	1.47*	--	1.27	1.10*	1.34*	0.97	1.53*	0.72*	--	--	1.42	1.27*	0.95	0.77*	1.42*	1.17*	
Northwestern	1.05	1.08*	1.91*	--	2.63*	1.23*	1.01	0.96	1.21*	1.31	--	--	--	0.81*	0.73*	1.53*	3.58*	1.27*	

Data source: Vital Statistics Records, Office of the Registrar General, Ontario Ministry of Consumer and Commercial Relations

Notes:

Inf.: Infectious and Parasitic Diseases; **Neo.:** Neoplasms; **End.:** Endocrine, Nutritional and Metabolic Diseases and Immunity Disorders; **Blo.:** Diseases of Blood and Blood-Forming Organs; **Men.:** Mental Disorders; **Ner.:** Diseases of the Nervous System and Sense Organs; **Cir.:** Diseases of the Circulatory System; **Res.:** Diseases of the Respiratory System; **Dig.:** Diseases of the Digestive System; **Gen.:** Diseases of the Genitourinary System; **Pre.:** Complications of Pregnancy, Childbirth and Puerperium; **Ski.:** Diseases of the Skin and Subcutaneous Tissue; **Mus.:** Diseases of the Musculoskeletal System and Connective Tissue; **Con.:** Congenital Anomalies; **Per.:** Certain Conditions Originating in the Perinatal Period; **Sym.:** Symptoms, Signs and Ill-Defined Conditions; **Inj.:** Injury and Poisoning; **All.:** All Causes

* Statistically significantly different from 1.00 ($p < 0.05$)

-- Indicates too few deaths to calculate a reliable SMR (less than five observed deaths)

TABLE 4 Demographic, social, economic and health characteristics of Ontario residents for public health units and health areas, 1996

Public Health Unit	1994 Pop. (ages 0-74)	Unemp. Rate	Low Inc.	< Gr.9 Educ.	Health Area†	Reg. Smo.	Reg. Exer.	BMIHeavy >27	Soc. Drink.	Soc. Sup.
Windsor-Essex	335,000	7.7	11.9	11.1	Essex	24.6*	58.9	30.4	5.8	89.7
Chatham-Kent	109,000	8.4	11.2	12.3	Kent, Lambton	22.5	58.9	33.5*	4.5	91.8*
Lambton	129,000	9.5	9.7	8.2						
Middlesex-London	382,000	8.9	13.5	7.4	Elgin, Oxford,	20.8	63.7	27.2	4.9	
89.4										
Elgin-St. Thomas	77,000	9.2	10.4	12.0	Middlesex					
Oxford	95,000	7.8	9.0	11.4						
Grey-Bruce-Owen Sound	149,000	8.7	11.2	12.0	Bruce, Grey,	22.0	59.8	34.7*	5.5	90.9
Huron	57,000	6.5	10.2	12.5	Perth, Huron					
Perth	70,000	5.3	7.1	13.2						
Brant	116,000	8.3	12.5	10.0	Brant, Haldimand-	25.1*	59.7	32.7*	4.0	90.9
Haldimand-Norfolk	101,000	9.3	9.1	13.3	Norfolk					
Hamilton	450,000	9.1	18.5	11.5	Hamilton	20.8	61.6	29.2	4.7	89.5
Niagara	391,000	9.6	12.5	10.6	Niagara	23.7*	64.4*	32.2*	5.9	89.9
Halton	332,000	5.6	7.5	4.9	Halton	19.0	65.1*	27.1	4.8	91.7*
Peel	826,000	8.1	13.6	8.0	Peel	19.1	57.5*	27.6	5.0	89.4
Waterloo	395,000	7.9	11.8	10.7	Waterloo	22.6	59.4	29.3	6.3	90.5
Wellington-Dufferin-Guelph	209,000	5.9	8.9	8.7	Wellington-Dufferin	21.3	59.8	27.1	5.5	91.5*
Toronto	2,262,000	10.7	24.4	12.2	Toronto	16.9*	57.5*	22.7*	4.9	87.5*
Simcoe	313,000	8.9	11.1	8.0	Simcoe	22.0	60.7	31.9*	5.4	91.9*
York	575,000	6.8	11.5	8.8	York	16.6*	59.9	26.1	3.8	90.4
Durham	445,000	8.1	9.7	6.3	Durham	23.1	62.3	25.4	3.8	90.8
Haliburton-Kawartha-	158,000	10.4	10.5	9.5	Northumberland,	22.9	62.2	30.2	5.1	90.7
Pine Ridge					Victoria, Haliburton,					
Peterborough	119,000	10.4	13.1	8.3	Peterborough					
Ottawa-Carleton	712,000	8.7	14.9	6.1	Ottawa-Carleton	20.4	67.0*	25.7	3.9	88.3
Renfrew	97,000	9.7	11.3	12.2	Renfrew, Prescott &	23.9	65.4*	32.5*	3.7	87.2
Eastern Ontario	182,000	9.5	12.9	13.1	Russell, Stormont,					
Kingston-Frontenac-	168,000	9.7	12.6	7.8	Dundas & Glengarry	25.5*	63.8*	31.6*	5.0	89.0
Lennox-Addington					Lanark/Leeds/Grenville,					
Hastings-Prince Edward	143,000	10.8	13.2	10.4	Hastings, Prince					
Leeds-Grenville-Lanark	149,000	8.4	9.7	8.1	Edward, Frontenac,					
					Lennox & Addington					
Algoma	128,000	13.3	16.2	12.4	Algoma, Cochrane	28.5*	62.9	34.6*	6.0	89.2
Porcupine	93,000	11.6	12.4	15.8						
Sudbury	201,000	12.5	14.3	12.9	Manitoulin, Sudbury	26.9*	63.0	35.2*	6.1	88.5
Muskoka-Parry Sound	87,000	10.1	12.0	11.2	Muskoka, Parry Sound,	25.0*	61.4	34.9*	5.7	89.3
North Bay	85,000	12.0	14.6	11.8	Nipissing, Timiskaming					
Timiskaming	38,000	12.9	15.2	15.8						
Thunder Bay	157,000	11.1	10.8	10.9	Thunder Bay, Kenora,	27.8*	63.4	35.4*	6.5	90.8
Northwestern	87,000	11.7	8.0	15.4	Rainy River					
Ontario	10,419,000	9.1	14.8	10.0	Ontario	20.9	60.9	28.0	4.9	89.4

Data Source: Statistics Canada 1996 Census and 1996/97 National Population Health Survey

Notes: **Unemp. Rate:** % of unemployed labour force aged 15+ to total labour force aged 15+; **Low Inc.:** % of families below the low-income cut-off (based on 1995 income levels); **< Gr. 9 Educ.:** % of population aged 15+ with < grade 9 education; **Reg. Smo.:** % of population aged 12+ who smoke cigarettes in a daily basis; **Reg. Exer.:** % of population aged 12+ who exercise frequently; **BMI >27:** % of population aged 12+ with body mass index > 27; **Heavy Drink.:** % of current drinkers aged 12+ who consume 15+ drinks in the previous week; **Soc. Sup.:** % of population aged 12+ with a high social support index

* Significantly different from provincial rate ($p < 0.05$) (for 1996/97 National Population Health Survey data)

† Derived geographic areas from the 1996/97 National Population Health Survey