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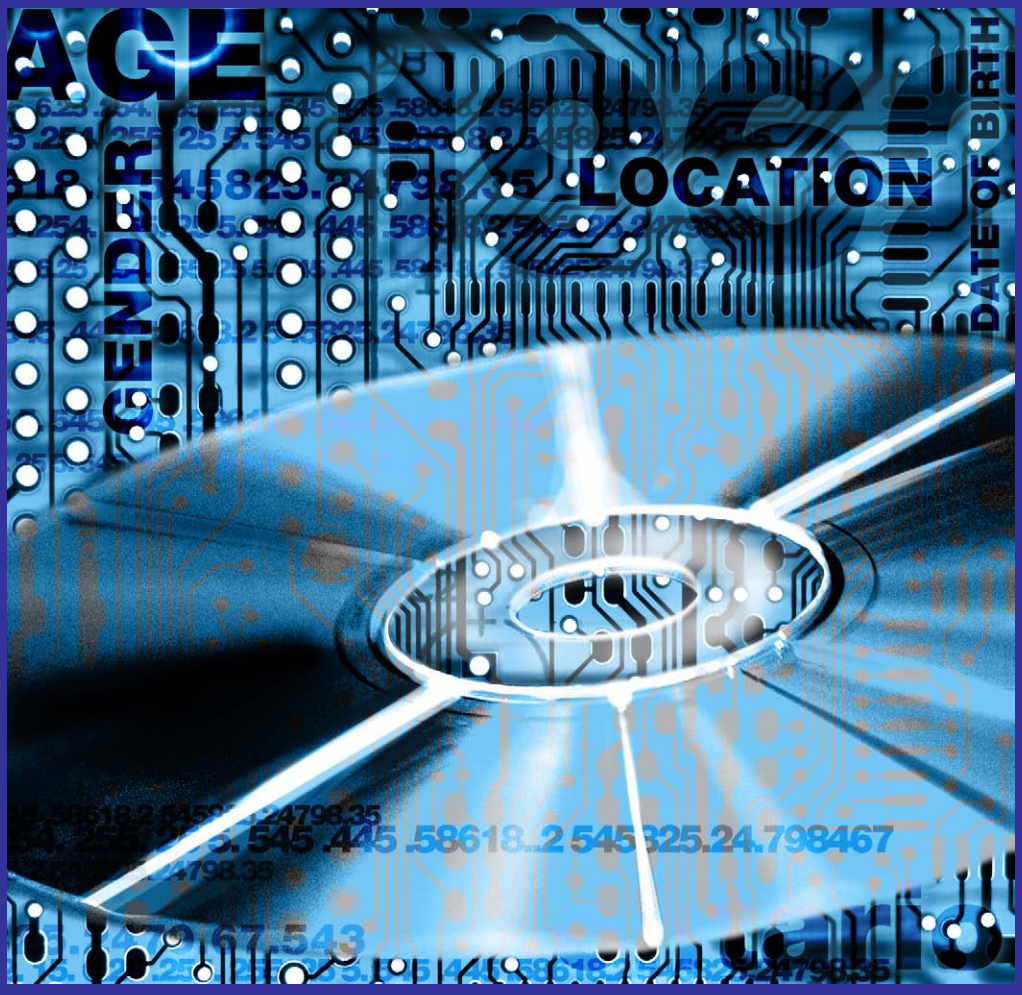
ICES Institute for Clinical Evaluative Sciences

Living and Dying in Ontario: An Opportunity for Improved Health Information



ICES Investigative Report

March 2008

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About ICES

Ontario's resource for informed health care decision-making

The Institute for Clinical Evaluative Sciences (ICES) is an independent, non-profit organization that produces knowledge to enhance the effectiveness of health care for Ontarians. Internationally recognized for its innovative use of population-based health information, ICES' evidence supports health policy development and guides changes to the organization and delivery of health care services.

Key to our work is our ability to link population-based health information, at the patient-level, in a way that ensures the privacy and confidentiality of personal health information. Linked databases reflecting 12 million of 30 million Canadians allow us to follow patient populations through diagnosis and treatment, and to evaluate outcomes.

ICES brings together the best and the brightest talent under one roof. Many of our scientists are not only internationally recognized leaders in their fields, but are also practicing clinicians who understand the grassroots of health care delivery, making the knowledge produced at ICES clinically-focused and useful in changing practice. Other team members have statistical training, epidemiological backgrounds, project management or communications expertise. The variety of skill sets and educational backgrounds ensures a multi-disciplinary approach to issues and creates a real-world mosaic of perspectives that is vital to shaping Ontario's future health care system.

ICES receives core funding from the Ontario Ministry of Health and Long-Term Care. In addition, our faculty and staff compete for peer-reviewed grants from federal funding agencies, such as the Canadian Institutes of Health Research, and project-specific funds are received from provincial and national organizations. These combined sources enable ICES to have a large number of projects underway, covering a broad range of topics. The knowledge that arises from these efforts is always produced independent of our funding bodies, which is critical to our success as Ontario's objective, credible source of *Evidence Guiding Health Care.*

Executive Summary

Good quality health care data provide a critical foundation for health services planning, policy development and system performance evaluation. This report assesses information in the Registered Persons' Database (RPDB)– a population-based register maintained by the Ministry of Health and Long-Term Care (MOHLTC) to manage publicly funded health care services covered under the Ontario Health Insurance Plan (OHIP). The RPDB is essentially an historical listing of the unique health numbers issued to each person eligible for Ontario health services. This listing includes corresponding demographic information such as date of birth, sex, address, date of death (where applicable), and changes in eligibility status. It is the only database that contains information about virtually the entire provincial population.

Aside from helping the MOHLTC to manage the use of health services, the RPDB is used by different stakeholders for an array of other purposes. The main ones are:

- health care system planning
- health care system performance, evaluation and research
- supporting the move to electronic health systems and more streamlined clinical care

Data users have highlighted four issues concerning RPDB data:

- The database contains out-of-date or incorrect address information for some currently registered persons.
- There is a discrepancy between the number of valid and eligible health numbers defined in the RPDB and in the number of people estimated by Statistics Canada to be living in Ontario at given times and across different parts of the province.
- The database contains some incorrect information about deaths in Ontario at given times and across different parts of the province.
- The RPDB is currently not accessible to most data users. The organization and interpretation of the information in the register pose challenges, even to experienced users.

The purpose of our investigation was threefold:

- How well does the number of people eligible for health care, as indicated by the RPDB data, correspond with population estimates for Ontario collected by Statistics Canada? How do these counts vary over time and across age groups, sex and Local Health Integration Networks (LHINs)?
- How well does the number of deaths as indicated by the RPDB data correspond with death counts in the Ontario health planning database? How do these counts vary over time and across age groups, sex and LHINs?
- Does augmenting the RPDB with additional geographic and demographic information (gained by linking the RPDB with health services utilization data) usefully provide more complete information about where people in Ontario live and die?

The Institute for Clinical Evaluative Sciences (ICES) receives regular updates to RPDB files from the MOHLTC. ICES takes advantage of its ability to anonymously link these data to other health services data sets which may contain more up-to-date address and death information. This creates a new version of the RPDB data (referred to here as “ICES-linked RPDB data") that is regularly used for ICES analyses.

Four data sets were used for this analysis:

- the RPDB as it is received by ICES from the MOHLTC
- an augmented version of the RPDB prepared by ICES which uses other administrative data sources to augment address and death information
- population estimates from Statistics Canada grouped by year, age, sex and LHIN
- death counts from the MOHLTC health planning database grouped by year, age, sex and LHIN

In the course of analysis, the number of anonymized health numbers (as a proxy for people eligible for health care in Ontario) in the RPDB were compared to:

- the number of people living in Ontario each year (1993 to 2003), and the number of Ontarians grouped by age, sex and LHIN for 2003 as described by Statistics Canada population estimates
- the number of deaths in Ontario in each year (1993 to 2003), and the number of deaths grouped by age, sex and LHIN for 2003, as described in Ontario’s health planning database
- the number of people eligible for health care, and the number of deaths in each year (1993 to 2003), grouped by age, sex and LHIN for 2003, as described in the ICES-linked RPDB data set

Based on the findings of this analysis we recommend that the RPDB be used cautiously by planners, decision makers and researchers for the following purposes:

- to conduct analyses by LHIN
- to conduct other geography-based analyses, especially those involving Toronto and its surrounding areas
- to conduct analyses for persons aged 85 years and older
- to quantify and/or examine deaths in infants and children, particularly those under four years old

We suggest the following changes be made to the current health information system:

- Updated address and other demographic information should be required for all Ontarians who are eligible for health care. The MOHLTC is currently implementing such an initiative.
- Data elements that are collected to maintain the RPDB should be assessed for their potential use in improving the quality of the data for health planning.
- When an Ontario resident dies, the deceased person's health number should be added to the provincial record maintained by the Office of the Registrar General (ORG). This would enhance the accuracy of death count information in the RPDB and better serve efforts at health planning and evaluation.
- Paying greater attention to ensuring that complete and accurate postal code information is included on ORG Vital Statistics death certificates would greatly improve the quality of data currently used for health planning and evaluation.

These few modest changes in the system of collecting information about Ontarians would improve users’ ability to utilize and rely on RPDB data. Our study has demonstrated that, in some cases, augmenting the RPDB with other sources of health services data appears to improve the utility of RPDB data. A cooperative discussion among data custodians and users to address the above issues would greatly elevate the quality of health information which is so vital to improving Ontario’s health care system.

Contents

List of Exhibits

Introduction and Context

Good quality health care data provide a critical foundation for health services planning, policy development and system performance evaluation. Previous reports published by the Institute for Clinical Evaluative Sciences (ICES) and others have described the characteristics of "good" data. They also suggest how poor-quality data can impact health planning decision-making.[1-3]

This report assesses information in the Registered Persons' Database (RPDB)–a population-based register maintained by the Ministry of Health and Long-Term Care (MOHLTC) to manage publicly funded health care services covered under the Ontario Health Insurance Plan (OHIP). The RPDB is essentially a historical listing of the unique health numbers issued to each person eligible for Ontario health services. This listing also contains corresponding demographic information such as date of birth, sex, address, date of death (where applicable), and changes in eligibility status. It is the only database that contains information about virtually the entire provincial population. *(See Section 3.2 for more details about the RPDB.)*

Aside from helping the MOHLTC to manage the use of health services, the RPDB is used by different stakeholders for an array of other purposes. The main ones are listed here:

- **Health care system planning**
  - The MOHLTC, along with various regional and disease-specific health planners, rely on the RPDB to understand the number of people eligible for health care who live and die in various parts of the province. This is the fundamental building block for health services planning. For example, health service planners in each of Ontario's 14 Local Health Integration Networks* (LHINs) need accurate demographic information about the people who live in their areas in order to provide funding for appropriate health services.

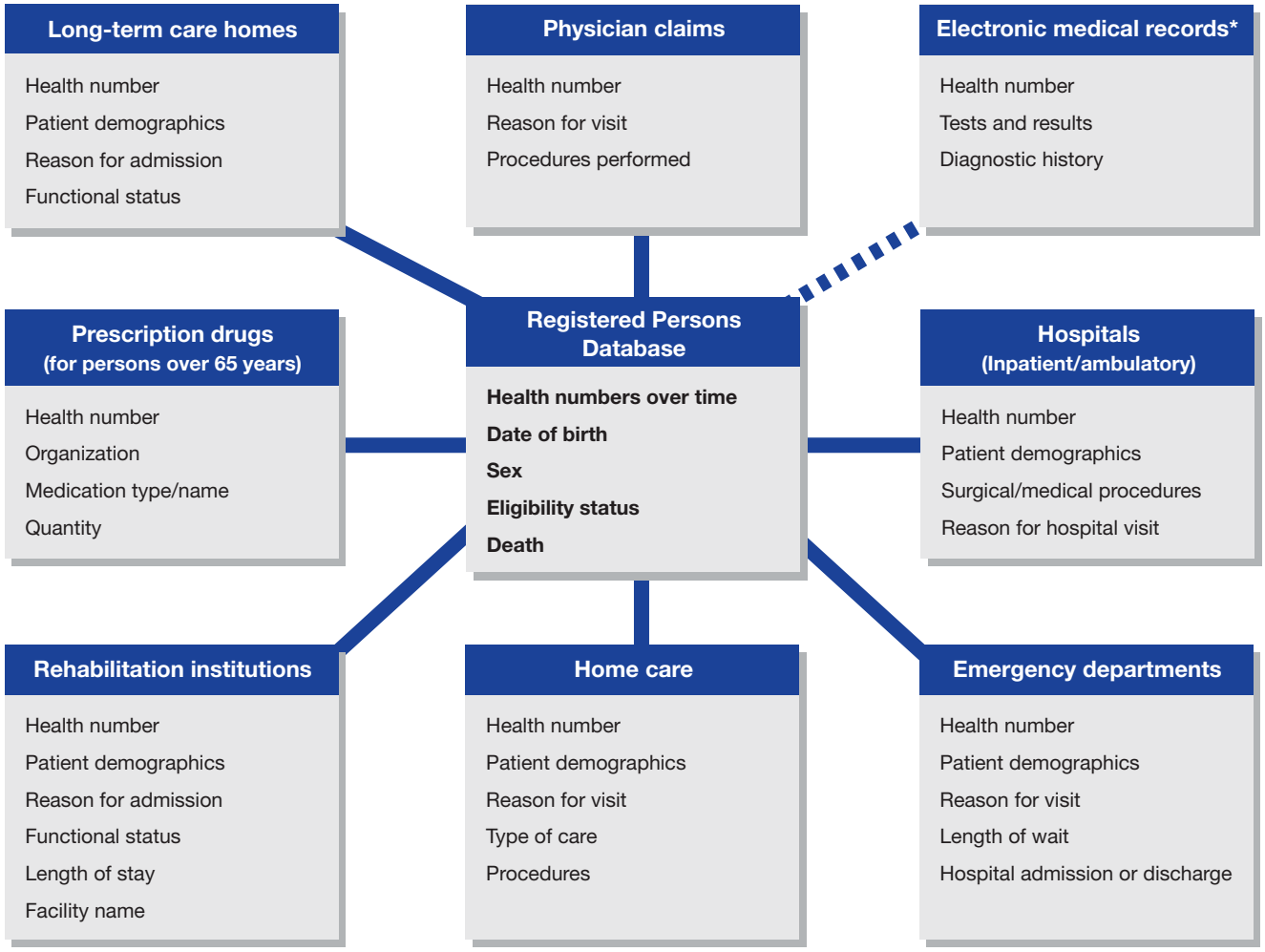
- **Health care system performance, evaluation and research**
  - The RPDB is often used in concert with other administrative health services data (Exhibit 1) to better understand important outcomes of health service provision. For example, linking the RPDB with data about inpatient hospital services, outpatient physicians' services, home care services and prescription drugs dispensed (for persons 65 years of age and over) helps to answer questions such as: "What happens to people who have been diagnosed with diabetes? Do they have a regular family doctor? Does follow-up care by a specialist depend on the patients' age, sex or place of residence? Are people in one geographical area more likely to receive home care than those living in another area? Are patients receiving the proper medications? Who is admitted to the hospital and for what reason? How many people die in a given year?"

    Such knowledge is vital in determining the need for services and in evaluating the quality, effectiveness and cost-effectiveness of health care provision.

- **Supporting the move to electronic health systems and streamlined clinical care**
  - Canada Health Infoway is a federally funded, independent organization aimed at promoting a national electronic health information system. The technical architecture of this system suggests that each province requires a functioning client registry to accurately integrate various types of medical information. A high-quality, population-based registry ensures, for example, that the results of an individual's health care tests or other medical information can be linked correctly to his or her medical file. At the present time, the RPDB is the only data set in Ontario that can act as a central health care client registry.

*Ontario's Local Health Integration Networks (LHINs) are not-for-profit corporations created in 2006. They work with local health providers and community members to determine health services priorities for their regions. LHINs do not provide services directly, but instead are responsible for planning, integrating and funding health care services in each specific geographic area. There are currently 14 LHINs in Ontario.

Exhibit 1. Examples of administrative health information used to manage Ontario's health care system



*A fully functioning electronic medical record system does not yet exist in Ontario. Such a system is currently in development.

Concerns about the quality of data in the Registered Persons Database

Data users have highlighted four issues concerning RPDB data. These are listed below:

- The database contains out-of-date or incorrect address information for some currently registered persons.
  - Address information in the RPDB may not be up-to-date for persons holding older red-and-white health cards. These cards do not expire, and card holders are not currently required to notify the MOHLTC about address changes. It is estimated that 44 percent of the 12.9 million valid health cards circulating in Ontario in 2006 were the older red-and-white cards. The remainder were newer photo I.D. health cards introduced in 1995.[4]
  - According to the 2006 Annual Report of the Auditor General cited above, the MOHLTC attempted to contact persons with the red-and-white health cards by mail, asking them to supply updated personal information. However, 25 percent of these notices, which were mailed to the addresses shown in the RPDB, were returned as "undeliverable."
  - The MOHLTC is implementing a conversion of the older red-and-white cards to newer cards which expire and require regular updating of personal information. However, the Auditor General suggests that, at the current rate, this conversion will not be complete until 2020.[4]
  - There is a discrepancy between the number of unique and eligible health numbers defined in the RPDB and in the number of people estimated by Statistics Canada to be living in Ontario at given times and across provincial geographic regions. This discrepancy exceeds the expected difference between these two data sources.
  - According to the 2006 Annual Report of the Auditor General of Ontario,[4] the RPDB indicated there were 200,000 more registered health cards with valid health numbers being used in the province than the number of people living in Ontario (as cited by Statistics Canada population estimate for that year). The majority of these extra cards (86 percent) appeared to be circulating in the Toronto area; four percent were tentatively traced to parts of southern Ontario which border U.S. states.[4]

- The database contains some incorrect information about deaths in Ontario at given times and across provincial geographic regions.
  - When a resident of Ontario dies, his or her health number is retired. This event can be recorded in the RPDB through three main methods:
    - The family or health practitioner of a deceased person may directly notify the MOHLTC. Since the health card is the property of the government, it is supposed to be returned to an OHIP office, and the health number is retired accordingly.
    - A doctor practicing within the OHIP submits a claim for a physician-attended death. This claim may be used to flag a death in the RPDB.
    - The MOHLTC receives information about deaths registered under the authority of the *Vital Statistics Act* by the Provincial Office of the Registrar General (ORG) so that the health number of the deceased can be retired. However, the deceased person's health number is not recorded on the ORG death certificate. Therefore, the name, date of birth and sex of a recently deceased person must be matched to the same information in the RPDB before the person's health number can be retired. (Note: If an adequate match is not secured, a deceased person's health number may be retained until further verification of death can be obtained. To this end, the RPDB may define persons who are actually dead as being eligible for health care; conversely, it may define a smaller number of people as being dead who are, in fact, alive. [Personal communication, S. Schultz, Institute for Clinical Evaluative Sciences, 2007.] Someone belonging to this latter group will need to have his or her card activated the next time health services are sought.)

- The RPDB is not accessible to most data users. The organization and interpretation of the information in the register pose challenges, even to experienced users.
  - As is the case with other health services administrative databases, the RPDB was developed and designed for management purposes. Data are organized across multiple complex files that require sophisticated linkage, making the files difficult to manipulate and interpret.

Why This Analysis was Conducted

The purpose of our investigation was to answer the following questions:

- How well does the number of people eligible for health care, as indicated by the RPDB data, correspond with population estimates for Ontario collected by Statistics Canada? How do these counts vary over time and across age groups, sex and Local Health Integration Networks (LHINs)?
- How well does the number of deaths contained in RPDB data correspond with the number of deaths contained in Ontario's health planning data? How do these counts vary over time and across age groups, sex and LHINs?
- Does augmenting the RPDB with additional geographic and demographic information (gained by linking the RPDB with health services utilization data) usefully provide more complete information about where people in Ontario live and die?

Data Sources Used for This Analysis

A note about privacy

ICES routinely receives health services administrative data feeds according to a data-sharing agreement with the Ministry of Health and Long-Term Care (MOHLTC). This agreement is signed in accordance with the 2004 *Personal Health and Information Protection Act* (PHIPA; section 45 [1] and O. Reg 329/04 section 19 [1]) which designates ICES as a "prescribed entity" in the Province of Ontario. This designation allows ICES to legally store and use encrypted, individual-level personal health information for the purposes of health system reporting, evaluation and research. Access to individual-level encrypted data is strictly controlled. No persons can be identified and no information about individual persons can be released.

Data sources

Four data sets were used for this analysis:

- individual-level RPDB data as ICES receives them from the MOHLTC
- individual-level, augmented RPDB data prepared by ICES (referred to here as "ICES-linked RPDB data") which uses other administrative data sources to add up-to-date address and death information
- a data file from Statistics Canada of population estimates, grouped by year, age, sex and Local Health Integration Network (LHIN), corresponding to each person's home address
- a data file from the MOHLTC used for health planning purposes which contains death counts grouped by year, age, sex and the LHIN corresponding to the deceased person's home address

These are discussed in more detail below.

About the Registered Persons Database (RPDB)

Almost all Ontario residents are eligible for government-funded health care and are therefore included in the Registered Persons Database (RPDB).

Under Canada's system of universal health insurance, which encompasses the Ontario Health Insurance Plan (OHIP), every person eligible for health care services carries a card with a unique number on it.[5] This card must be presented each time a patient receives a health service that is covered under OHIP, such as a physician visit or a surgical procedure.

New health numbers and cards are issued for newborns, immigrants and others who make Ontario their long-term residence. Health numbers are retired as people die or relocate to another province or country. Health numbers are reissued when persons return to Ontario after being away for long periods of time. Demographic information—such as date of birth, date of death, sex and address—associated with each unique health number is also recorded in the RPDB. The RPDB tracks changes in eligibility status and demographic information over time.

When RPDB data arrive at ICES each month, a unique and anonymous ICES key number (IKN) is assigned, according to each unique health number. This unique IKN runs across all administrative data sets to allow for linkage. Only restricted ICES staff are allowed to use the RPDB data. The RPDB files are processed at ICES by removing duplicate records where appropriate and by de-identifying personal health information.

(Note: ICES relies on the RPDB for information about whether and when a death has occurred in Ontario; the Office of the Registrar General is currently unable to provide a direct data feed to ICES.)

About the ICES-linked RPDB

After receiving RPDB data from the MOHLTC, ICES takes advantage of its ability to anonymously link these data to other health services data sets which may contain more up-to-date address and death information. The RPDB is cleaned and linked as follows:

- A hierarchical algorithm is used to search across administrative data sets for the best known or most recent postal code and/or city of residence for each person in the database on July 1 of each year. The data sets that are scanned are: the Hospital Discharge Abstracts Database (DAD); the National Ambulatory Care Reporting System (NACRS); the Continuing Care Reporting System (CCRS); the Levels of Care Classification System (LOC); and the National Rehabilitation System (NRS). These are all collected and maintained by the Canadian Institute for Health Information (CIHI). ICES obtains these data sets through the data-sharing agreement mentioned above.
- The Statistics Canada Postal Code Conversion File plus (PCCF+ version 4J)[6] is used to translate each person's postal code to a geographic area in Ontario. Each postal code associated with a health number in the RPDB is rolled up to a dissemination area (DA) and then to a LHIN area. The ICES-linked data uses information about the person's city of residence (rescodes) posted within other administrative data sets to further allocate Ontarians into LHIN areas.
- The death information in the RPDB is similarly adjusted by ICES through linkage to death dates noted in the health administrative data listed above (where death information is available). Since about 60 percent of all deaths in Ontario occur in hospitals, deaths not captured in the RPDB may be captured using linked data.[7]
- Administrative data files are also scanned to determine the date of last contact with the health care system (hospitals, physicians or long-term care homes) associated with each unique and valid health number. This added information provides a clearer picture of how Ontario's health services are used in relation to eligibility/ retirement of health numbers for each year of analysis.

About Statistics Canada population estimates for Ontario

ICES receives grouped Statistics Canada population estimates, organized by year, age, sex and geographical area, via the MOHLTC. The Statistics Canada annual population estimates are based on the Census counts and on intercensal population projections. Adjustments are made at Statistics Canada that take immigration, emigration, deaths and births into consideration to estimate the number of persons living in each province on July 1 for each year.

Population estimates from 1993 to 2003 were used for this analysis. Age, sex and LHIN analyses were performed for the year 2003. The LHIN designations for this year were developed by the Ontario Ministry of Finance using census sub-divisions and the MOHLTC residence coding system.[8]

About death counts in Ontario

ICES does not currently receive individual-level Vital Statistics death data collected by the Ontario Office of the Registrar General (ORG). Therefore, this analysis utilized death counts from an aggregated, unlinked data set created by the MOHLTC for the purposes of health planning and referred to in this report as "Ontario health planning data." The death data contained in this data set combines ORG Vital Statistics death data and Statistics Canada death information for Ontario residents who die outside the province. Direct access to this Ontario-based planning data set is restricted.

In February 2007, ICES received an aggregated table of Ontario death counts grouped by age, sex and LHIN for the years 1993 to 2003. Age, sex and LHIN analyses were performed for the year 2003. The LHIN designations for this year were developed by the Ontario Ministry of Finance using census sub-divisions and the MOHLTC residence coding system.[8]

(See Appendix A for a more detailed account of the how the data elements were organized for this analysis.)

How the Analysis Was Done

RPDB data were used to count the number of people eligible for health care in Ontario (according to valid and unique health numbers in the RPDB) and also to count the number of people who died each year from 1993 to 2003. Data were grouped by age, sex and the Local Health Integration Network (LHIN) corresponding to each person's home address for the year 2003. As with all ICES data, health numbers were encrypted using an ICES-based algorithm.

This information was compared to:

- the number of people living in Ontario each year (1993 to 2003), and the number of Ontarians grouped by age, sex and LHIN for 2003 as described by Statistics Canada population estimates
- the number of deaths in Ontario each year (1993 to 2003), and the number of deaths grouped by age, sex and LHIN for 2003, as described in Ontario's health planning database
- the number of people eligible for health care and the number of deaths in each year (1993 to 2003), as well as deaths grouped by age, sex and LHIN for 2003, as described in the ICES-linked RPDB database

Findings and Exhibits

Population living in Ontario

How well does the number of people eligible for health care, as indicated by the RPDB data, correspond with population estimates for Ontario collected by Statistics Canada? How did these counts vary over time and by age groups, sex and Local Health Integration Network (LHIN)?

The RPDB and population estimates by year

Key findings:

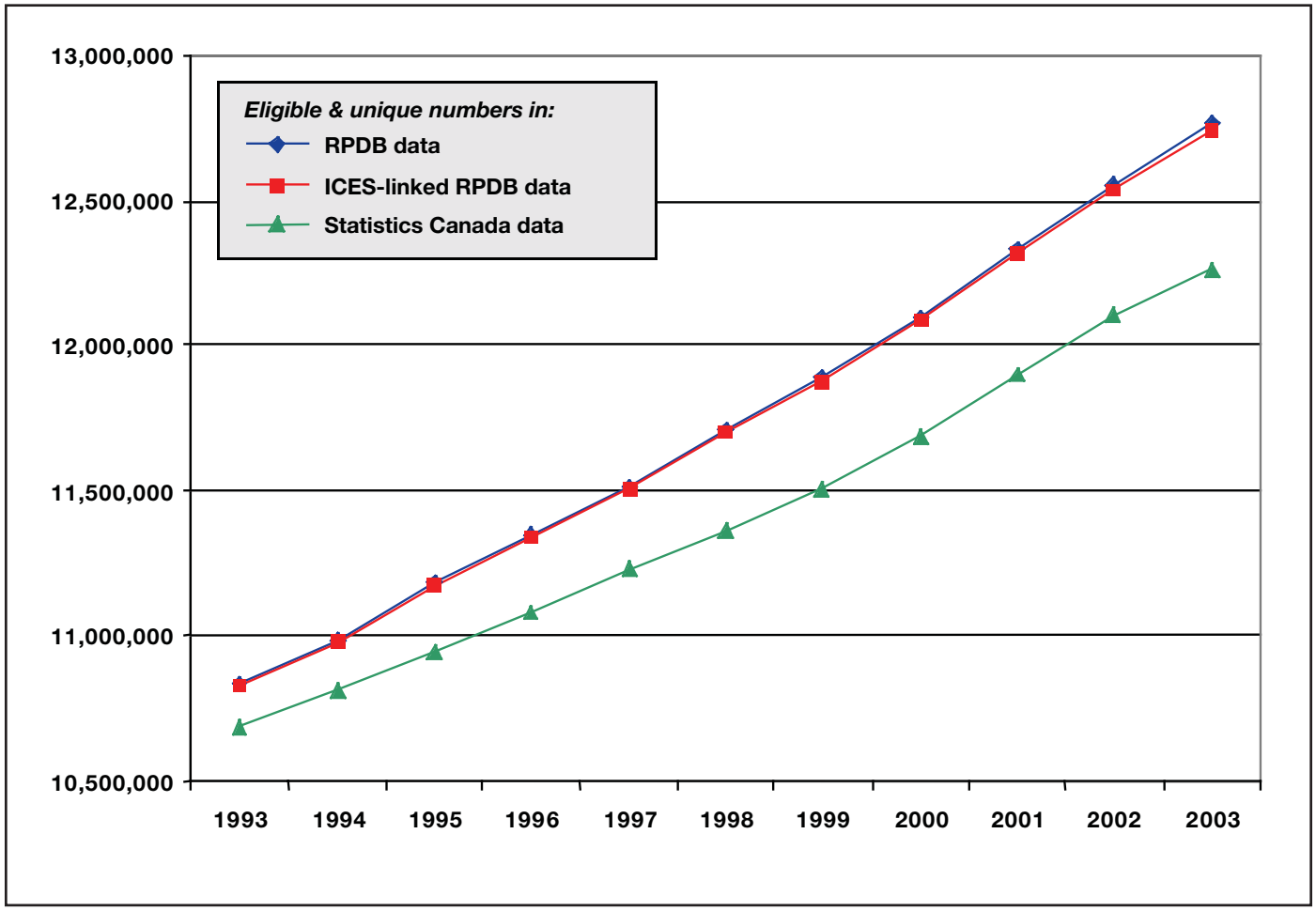
- The population of Ontario increased by 15 percent from 1993 to 2003 according to Statistics Canada population estimates, and by 18 percent according to RPDB data.
- Both the RPDB data and the ICES-linked RPDB population counts were higher than the Statistics Canada population estimates in each year. The magnitude of the over-count increased from one percent in 1993 to four percent in 2003 in both data sets. *(See Exhibits 2 and 3.)*

Exhibit 2. The number of and percent difference in eligible and unique health numbers in RPDB* data, in ICES-linked RPDB** data, and in Statistics Canada population estimates, in Ontario, 1993–2003

				Absolute difference compared to Statistics Canada population estimates		Percent difference compared to Statistics Canada population estimates	
	RPDB data	ICES-linked RPDB data	Statistics Canada population estimates	RPDB data	ICES-linked RPDB data	RPDB data (%)	ICES-linked RPDB data (%)
1993	10,835,424	10,832,741	10,688,391	147,033	144,350	1.38	1.35
1994	10,984,755	10,980,980	10,818,251	166,504	162,729	1.54	1.50
1995	11,184,274	11,179,312	10,949,976	234,298	229,336	2.14	2.09
1996	11,348,574	11,342,787	11,083,052	265,522	259,735	2.40	2.34
1997	11,517,269	11,510,086	11,228,284	288,985	281,802	2.57	2.51
1998	11,709,051	11,699,735	11,367,018	342,033	332,717	3.01	2.93
1999	11,888,035	11,876,730	11,506,359	381,676	370,371	3.32	3.22
2000	12,098,650	12,085,144	11,685,380	413,270	399,764	3.54	3.42
2001	12,332,213	12,318,127	11,897,627	434,586	420,500	3.65	3.53
2002	12,555,184	12,537,190	12,102,041	453,143	435,149	3.74	3.60
2003	12,762,004	12,742,345	12,259,564	502,440	482,781	4.10	3.94

*RPDB=Registered Persons Database, Ministry of Health and Long-Term Care
**ICES-linked RPDB=This data set links to Ontario administrative databases to create a yearly file with the most up-to-date geographic and death information.

Exhibit 3. The number of eligible and unique health numbers in RPDB* data, in ICES-linked RPDB** data, and in Statistics Canada population estimates, in Ontario, 1993–2003



*RPDB=Registered Persons Database, Ministry of Health and Long-Term Care
**ICES-linked RPDB=This data set links to Ontario administrative databases to create a yearly file with the most up-to-date geographic and death information.

The RPDB and Statistics Canada population estimates by age groups in 2003

Key findings:

- Among people under age 85 years, the difference in population counts were similar across the RPDB data, the ICES-linked RPDB data and Statistics Canada estimates, ranging from one percent in the youngest age group to seven percent in the middle age groups (35–39 years to 45–49 years). There were fewer persons ages 20–24 in the RPDB than in the Statistics Canada population estimate; this observation may reflect a healthy and mobile population who may be less likely to seek health services than other age groups. *(See Exhibits 4 and 5.)*
- In the 85–89 years age group, the disparity between the RPDB eligible population counts and Statistics Canada population estimates was 12 percent (vs. an eight percent disparity between the Statistics Canada counts and counts from the ICES-linked data set).
- In the 90–105 years age group, the disparity between the RPDB file and the Statistics Canada population estimates was 32 percent (vs. a 21 percent disparity between the Statistics Canada counts and the ICES-linked data set). When persons over age 90 years with no health care system contact in the previous ten years were excluded from the ICES-linked file, the over count dropped from 21 percent to 11 percent. However, the accuracy of this adjustment is unknown.

Exhibit 4. The number of and percent difference in eligible and unique health numbers in RPDB* data, in ICES-linked RPDB data, and in Statistics Canada population estimates, by age group, in Ontario, 2003**

				Absolute difference compared to Statistics Canada population estimates		Percent difference compared to Statistics Canada population estimates	
Age group (years)	RPDB data	ICES-linked RPDB data	Statistics Canada population estimates	RPDB data	ICES-linked RPDB data	RPDB data (%)	ICES-linked RPDB data (%)
0-4	692,887	693,160	687,059	5,828	6,101	0.85	0.89
5-9	799,664	799,695	789,901	9,763	9,794	1.24	1.24
10-14	874,319	874,319	829,672	44,647	44,647	5.38	5.38
15-19	839,959	840,155	823,177	16,782	16,978	2.04	2.06
20-24	803,186	803,675	827,716	24,530	24,041	-2.96	-2.90
25-29	823,217	823,705	821,845	1,372	1,860	0.17	0.23
30-34	948,031	948,259	904,731	43,300	43,528	4.79	4.81
35-39	1,076,374	1,076,436	1,005,792	70,582	70,644	7.02	7.02
40-44	1,134,509	1,134,397	1,059,601	74,908	74,796	7.07	7.06
45-49	1,003,989	1,003,634	941,153	62,836	62,481	6.68	6.64
50-54	855,476	854,991	809,113	46,363	45,878	5.73	5.67
55-59	720,765	720,095	686,618	34,147	33,477	4.97	4.88
60-64	546,931	546,027	522,862	24,069	23,165	4.60	4.43
65-69	460,050	458,598	440,951	19,099	17,647	4.33	4.00
70-74	414,820	412,712	399,294	15,526	13,418	3.89	3.36
75-79	342,270	339,373	326,806	15,464	12,567	4.73	3.85
80-84	234,461	231,172	221,766	12,695	9,406	5.72	4.24
85-89	119,652	116,254	107,244	12,408	9,010	11.57	8.40
90+	71,444	65,688	54,263	17,181	11,425	31.66	21.05

continued on page 11

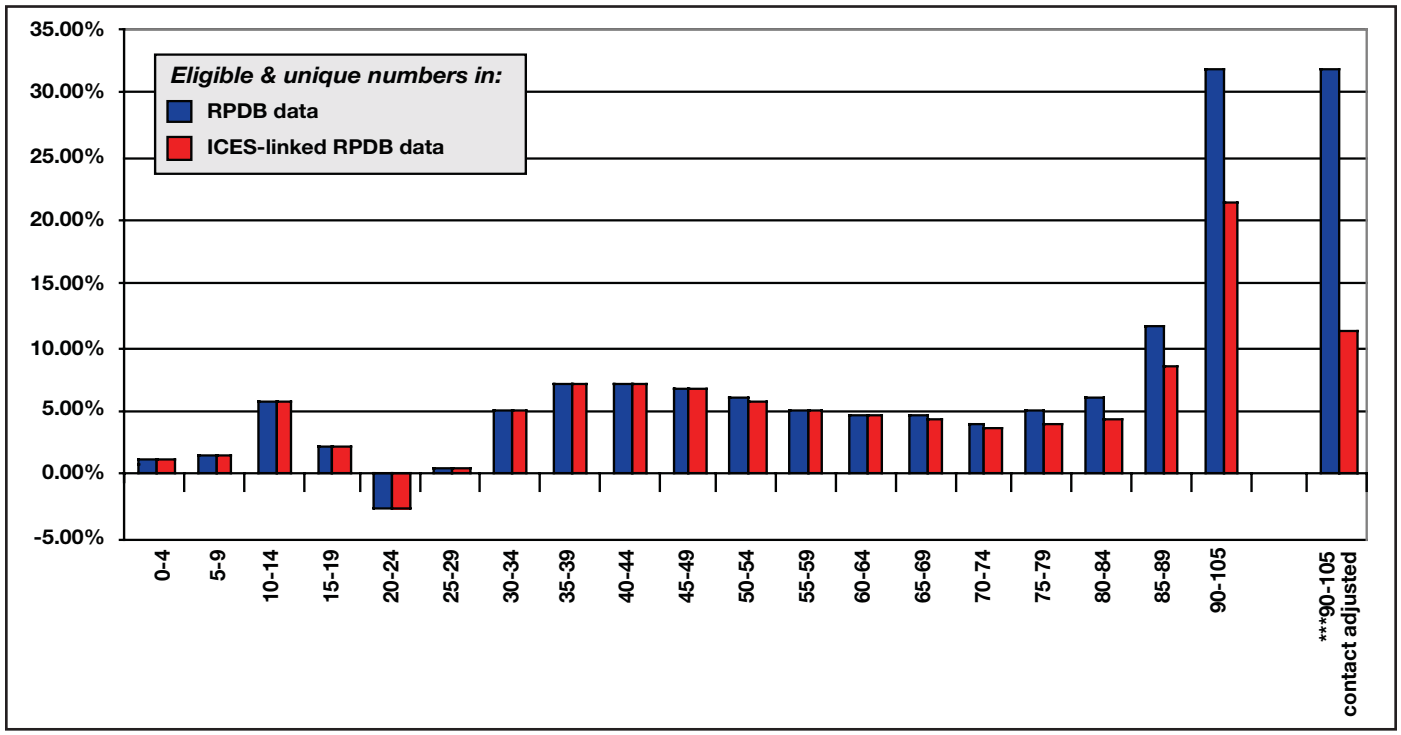
Exhibit 4. The number of and percent difference in eligible and unique health numbers in RPDB* data, in ICES-linked RPDB** data, and in Statistics Canada population estimates, by age group, in Ontario, 2003

continued from page 10

				Absolute difference compared to Statistics Canada population estimates		Percent difference compared to Statistics Canada population estimates	
Age group (years)	**RPDB data**	**ICES-linked RPDB data**	**Statistics Canada population estimates**	**RPDB data**	**ICES-linked RPDB data**	**RPDB data (%)**	**ICES-linked RPDB data (%)**
***90+ adjusted for date of last contact with health system		60,207	54,263		5,944		10.95

*RPDB=Registered Persons Database, Ministry of Health and Long-Term Care
**ICES-linked RPDB=This data set links to Ontario administrative databases to create a yearly file with the most up-to-date geographic and death information.
***The large overcount of persons older than 90 years could reflect the fact that the RPDB is an historical file. Persons are considered to be alive until they are proven to be dead. Although Vital Statistics death data that come directly from the ORG are routinely matched to the RPDB, over time some deaths may be missed. To adjust for such a potential accumulation, persons 90 years of age or over who did not have contact with the health system in the ten years prior to July 1, 2003 were excluded.

Exhibit 5. The percent difference in eligible and unique health numbers in RPDB* data, in ICES-linked RPDB** data, and in Statistics Canada population estimates, by age group, in Ontario, 2003



*RPDB=Registered Persons Database, Ministry of Health and Long-Term Care
**ICES-linked RPDB=This data set links to Ontario administrative databases to create a yearly file with the most up-to-date geographic and death information.
***Adjusted by linking to other data showing no contact with the health care system in the previous ten years.

The RPDB and population estimates by sex in 2003

Key findings:

- The number of persons living in Ontario deemed eligible for health services was four percent higher in the RPDB than in Statistics Canada population estimates, regardless of sex. *(See Exhibit 6.)*
- Adjustment of the data by ICES did not make a substantial difference in reducing this disparity for either sex.

Exhibit 6. The number of and percent difference in eligible and unique health numbers in RPDB* data, in ICES-linked RPDB data, and in Statistics Canada population estimates, by sex, in Ontario, 2003**

				Absolute difference compared to Statistics Canada population estimates		Percent difference compared to Statistics Canada population estimates	
Sex	RPDB data	ICES-linked RPDB data	Statistics Canada population estimates	RPDB data	ICES-linked RPDB data	RPDB data (%)	ICES-linked RPDB data (%)
Female	6,450,325	6,440,611	6,202,905	247,420	237,706	3.99	3.83
Male	6,311,679	6,301,734	6,056,659	255,020	245,075	4.21	4.05

*RPDB=Registered Persons Database, Ministry of Health and Long-Term Care
**ICES-linked RPDB=This data set links to Ontario administrative databases to create a yearly file with the most up-to-date geographic and death information.

The RPDB and population estimates by Local Health Integration Network (LHIN) in 2003

Key findings:

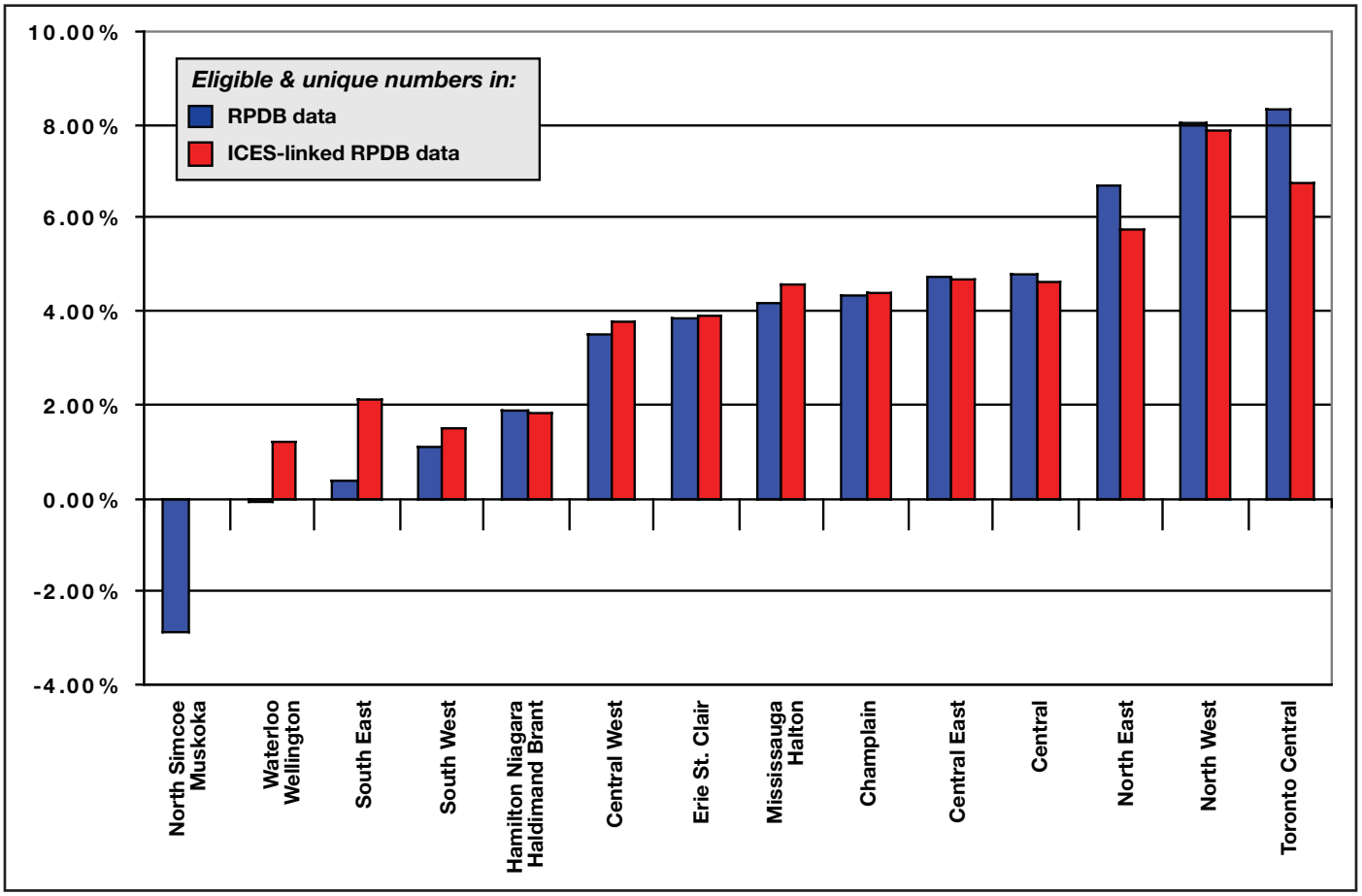
- In 2003, the magnitude of difference between the number of people eligible for health care contained in RPDB data and in Statistics Canada population estimates varied from three percent to eight percent across Ontario LHINs. *(See Exhibits 7 and 8.)*
- The RPDB data and ICES-linked RPDB data agreed most closely (i.e., a disparity of two percent or under) with the Statistics Canada population estimates in the following LHINs: North Simcoe Muskoka (when using ICES-linked RPDB data); Waterloo Wellington; South East; South West; and Hamilton Niagara Haldimand Brant.
- The RPDB data and ICES-linked RPDB data agreed least closely (i.e., disparity above six percent) with the Statistics Canada population estimates in the following LHINs: Toronto Central, North West, and North East.
- The RPDB contained more than 40,000 health numbers with postal codes that could not be mapped to a LHIN (i.e., the codes were missing or invalid). Adjustment of the data by ICES decreased this number by 75 percent; but this still left 10,000 health numbers in the RPDB with postal codes that could not be mapped to a LHIN.

Exhibit 7. The number of and percent difference in eligible and unique health numbers in RPDB* data, in ICES-linked RPDB data, and in Statistics Canada population estimates, by Local Health Integration Network (LHIN), in Ontario, 2003**

				Absolute difference compared to Statistics Canada population estimates		Percent difference compared to Statistics Canada population estimates	
Local Health Integration Network (LHIN)	RPDB data	ICES-linked RPDB data	Statistics Canada population estimates	RPDB data	ICES-linked RPDB data	RPDB data (%)	ICES-linked RPDB data (%)
North Simcoe Muskoka	398,047	409,810	409,823	11,776	-13	-2.87	0.00
Waterloo Wellington	677,727	686,311	678,115	-388	8,196	-0.06	1.21
South East	479,915	488,220	478,189	1,726	10,031	0.36	2.10
South West	929,706	933,249	919,627	10,079	13,622	1.10	1.48
Hamilton Niagara Haldimand Brant	1,368,924	1,368,427	1,343,698	25,226	24,729	1.88	1.84
Central West	729,597	731,475	704,890	24,707	26,585	3.51	3.77
Erie St. Clair	668,178	668,289	643,353	24,825	24,936	3.86	3.88
Mississauga Halton	1,043,912	1,047,682	1,001,885	42,027	45,797	4.19	4.57
Champlain	1,222,216	1,222,836	1,171,053	51,163	51,783	4.37	4.42
Central East	1,507,049	1,506,349	1,439,100	67,949	67,249	4.72	4.67
Central	1,576,810	1,573,599	1,504,356	72,454	69,243	4.82	4.60
North East	609,113	603,854	570,909	38,204	32,945	6.69	5.77
North West	262,630	262,232	243,039	19,591	19,193	8.06	7.90
Toronto Central	1,247,547	1,229,106	1,151,527	96,020	77,579	8.34	6.74
Missing or invalid postal code	40,633	10,906					

*RPDB=Registered Persons Database, Ministry of Health and Long-Term Care
**ICES-linked RPDB=This data set links to Ontario administrative databases to create a yearly file with the most up-to-date geographic and death information.
Note: Based on 2003 LHIN boundaries as defined by Ministry of Finance.

Exhibit 8. The percent difference in eligible and unique health numbers in RPDB* data, in ICES-linked RPDB** data, and in Statistics Canada population estimates, by Local Health Integration Network (LHIN), in Ontario, 2003



*RPDB=Registered Persons Database, Ministry of Health and Long-Term Care
**ICES-linked RPDB=This data set links to Ontario administrative databases to create a yearly file with the most up-to-date geographic and death information.

Discussion of specific findings about population estimates in the RPDB

There are several potential explanations for the disparities found between the number of people living in Ontario eligible for health care, and the number of people included in population estimates derived by Statistics Canada.

First and perhaps most important, the nature of these two data sets differs greatly. The RPDB is an historical registry that was created to help manage publicly funded health care in Ontario. Statistics Canada population estimates are based on the regular census of people residing in Canada, province by province. The disparity in the population counts for Ontario between these two data sources ranged from one percent in 1993 to four percent in 2003.

The number of people eligible for health care defined in the RPDB may be higher than the Statistics Canada population estimates for a number of reasons:

- Persons moving out of the province are not required to alert the Ministry of Health and Long-Term Care (MOHLTC). Their cases are flagged only if they apply for a health card in another province.
- The number of elderly persons in the RPDB data may be artificially inflated due to the historic nature of this database. Our analysis of the 90–105 years of age group conservatively removed eligible encrypted health numbers that had not been active for ten years prior to 2003. Such exclusion criteria could be applied across other age groups to understand how eligible persons use the health care system.
- Forty thousand (40,000) postal codes in the RPDB could not be mapped to LHINs because they were invalid or missing on the data file. Adjustment of the data by ICES reduced this to 10,000 postal codes.
- In Toronto and parts of Ontario bordering the northern United States (U.S.), a high degree of population mobility has been observed; this could account for over six percent difference between the RPDB counts and Statistics Canada population estimates in certain areas of the province. The 2007 Auditor's General report found that there was a higher likelihood of potentially suspicious health numbers in these geographical areas.[4]
- According to discussions with the MOHLTC, the number of valid *health cards* in Ontario (as opposed to unique *health numbers*) may be a more accurate reflection of how many Ontarians are eligible to receive health care services. This is because a person's *health number* may be retained in the RPDB even if his or her *health card* has been deactivated (because of presumed ineligibility due to death or leaving the province). Unfortunately, ICES does not currently receive information about valid health cards from the MOHLTC. These data may be available in the future.

Population dying in Ontario

How well do RPDB data correspond to death counts in the health planning data from the Ministry of Health and Long-Term Care? How do these counts vary over time and across age groups, sex and Local Health Integration Network (LHIN)?

Number of deaths in RPDB compared with number of deaths in Ontario health planning data by year

Key findings:

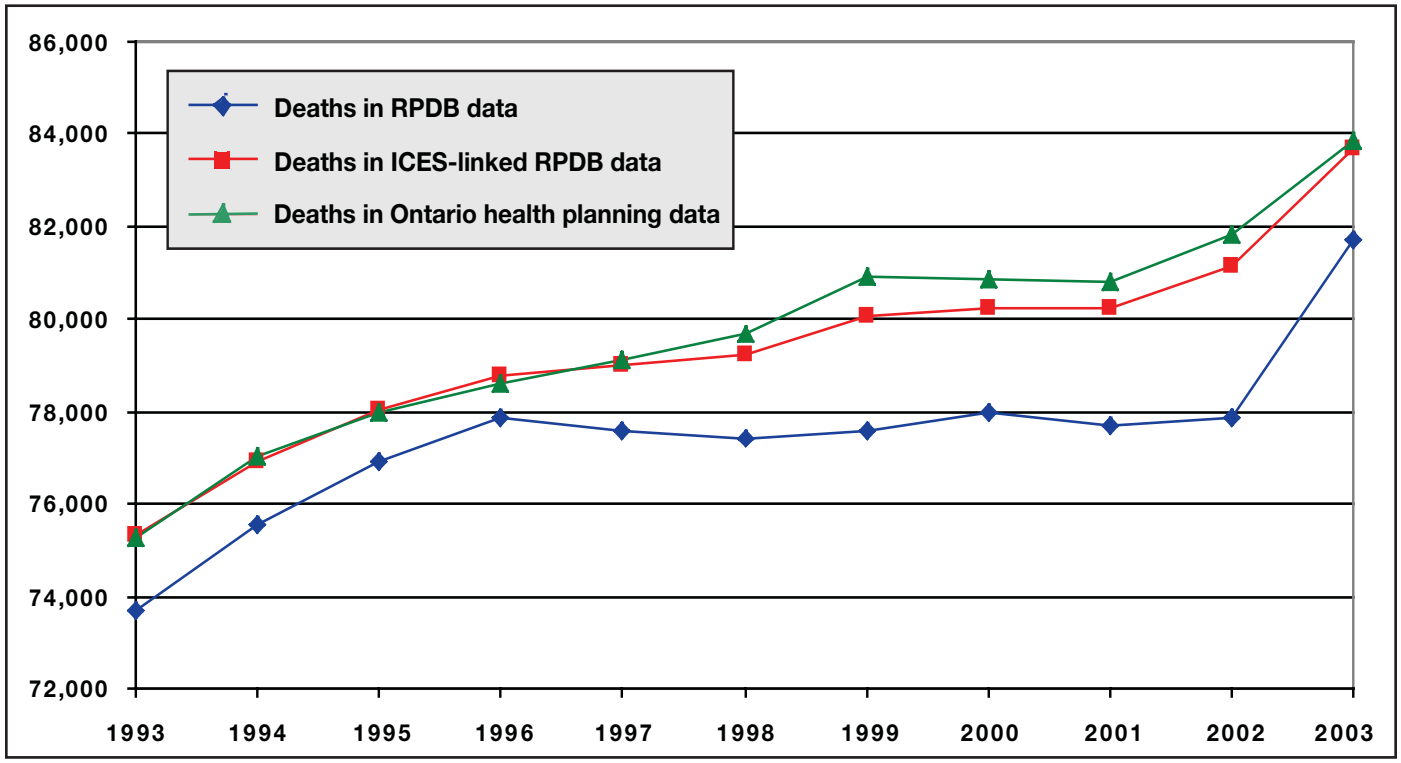
- The number of deaths recorded in the RPDB remained constant at approximately 78,000 annually from 1996 to 2002, and then increased to 82,000 in 2003. According to Ontario health planning data, the number of deaths in Ontario increased steadily from approximately 75,000 in 1993 to 84,000 in 2003. The number of deaths in the ICES-linked RPDB data also increased steadily over the same period of time. *(See Exhibits 9 and 10.)*
- In every year, the number of deaths in Ontario according to data from the RPDB was lower than the number of deaths according to Ontario health planning data.
- In every year, the number of deaths in the ICES-linked RPDB data corresponded more closely to the number of deaths in the Ontario health planning data.

Exhibit 9. The number of and percent difference in deaths in RPDB* data, in ICES-linked RPDB** data, and in Ontario health planning data,*** 1993–2003

				Absolute difference compared to Ontario health planning death counts		Percent difference compared to Ontario health planning death counts	
Year	RPDB data	ICES-linked RPDB data	Ontario health planning data	RPDB data	ICES-linked RPDB data	RPDB data (%)	ICES-linked RPDB data (%)
1993	73,699	75,322	75,290	-1,591	32	-2.11	0.04
1994	75,554	76,892	77,015	-1,461	-123	-1.90	-0.16
1995	76,937	78,026	77,989	-1,052	37	-1.35	0.05
1996	77,876	78,786	78,627	-751	159	-0.96	0.20
1997	77,585	78,982	79,117	-1,532	-135	-1.94	-0.17
1998	77,419	79,206	79,701	-2,282	-495	-2.86	-0.62
1999	77,587	80,059	80,939	-3,352	-880	-4.14	-1.09
2000	77,995	80,261	80,872	-2,877	-611	-3.56	-0.76
2001	77,722	80,260	80,830	-3,108	-570	-3.85	-0.71
2002	77,845	81,143	81,802	-3,957	-659	-4.84	-0.81
2003	81,734	83,675	83,831	-2,097	-156	-2.50	-0.19

*RPDB=Registered Persons Database, Ministry of Health and Long-Term Care
**ICES-linked RPDB=This data set links to Ontario administrative databases to create a yearly file with the most up-to-date geographic and death information.
***Ontario health planning data=Database maintained by MOHLTC containing death counts from the Ontario Registrar General (ORG) adjusted by Statistics Canada for deaths occurring outside Ontario.

Exhibit 10. The number of deaths in RPDB* data, in ICES-linked RPDB** data, and in Ontario health planning data,*** 1993–2003



*RPDB=Registered Persons Database, Ministry of Health and Long-Term Care
**ICES-linked RPDB=This data set links to Ontario administrative databases to create a yearly file with the most up-to-date geographic and death information.
***Ontario health planning data=Database maintained by MOHLTC containing death counts from the Ontario Registrar General (ORG) adjusted by Statistics Canada for deaths occurring outside Ontario.

RPDB death counts compared to Ontario health planning death counts by age in 2003

Key findings:

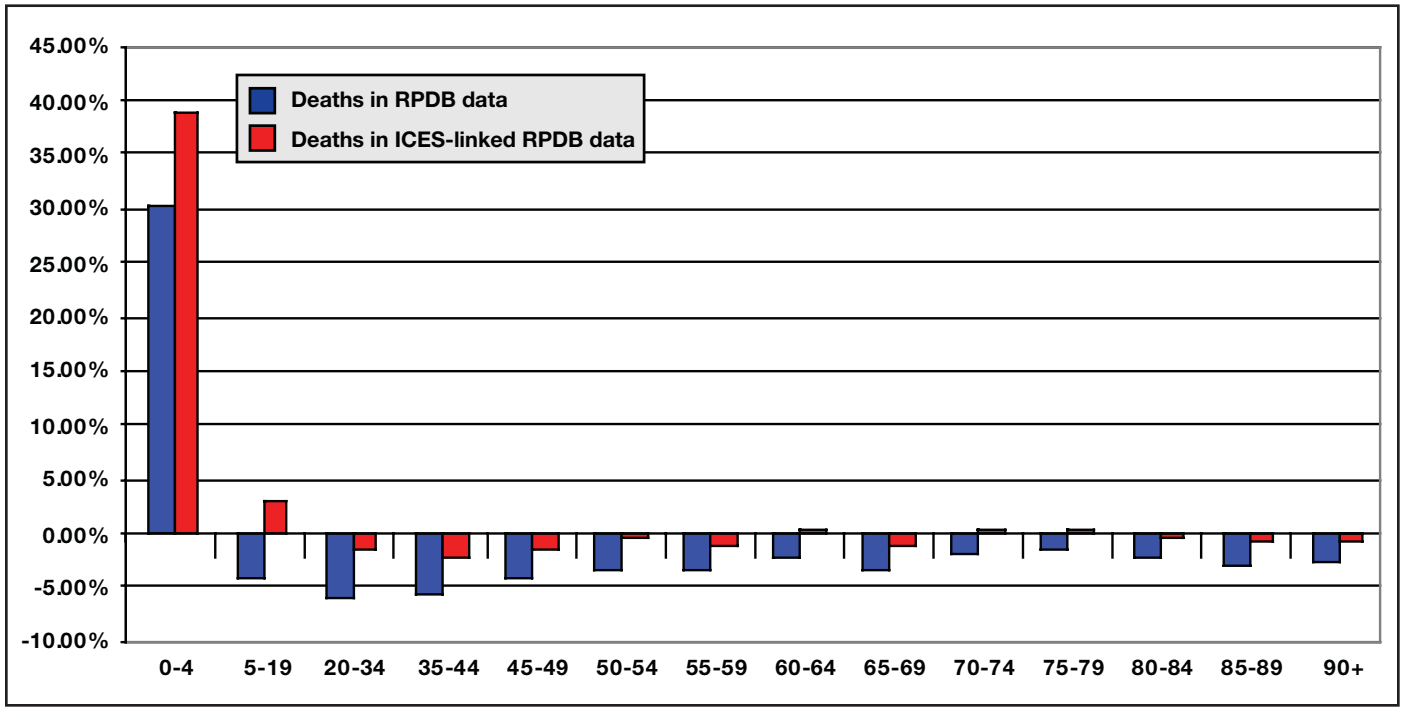
- In 2003, for persons over age 45 years, the RPDB death counts were between two and four percent below death counts in Ontario health planning data; the ICES-linked data more closely mirrored death counts in the Ontario health planning data in these age groups. *(See Exhibits 11 and 12.)*
- In 2003, for children under age four (0-4 years), there were 237 more deaths indicated in the RPDB compared to the number of deaths in Ontario health planning data. This discrepancy rose to 304 more deaths in the RPDB vs. the number in the ICES-linked RPDB. This result has been highlighted before in informal analyses conducted in recent years by ICES and others. (Note: According to Statistics Canada and previous analyses of RPDB data, about 85 percent of deaths in the 0-4 years age group occur in infants under the age of one year. The Ontario health planning data used in this analysis could not be disaggregated in this fashion.)
- In children ages five to 19 years, the number of deaths in this age group according to the RPDB was four percent lower than the number of deaths in Ontario health planning data. This discrepancy increased to three percent higher when the comparison was between the number of deaths in this age group in the ICES-linked RPDB and in Ontario's health planning data. The reason for this difference is unknown at present.

Exhibit 11. The number of and percent difference in deaths in RPDB* data, in ICES-linked RPDB data, and in Ontario health planning data,*** by age group, 2003**

				Absolute difference compared to Ontario health planning death counts		Percent difference compared to Ontario health planning death counts	
Age group (years)	RPDB data	ICES-linked RPDB data	Ontario health planning data	RPDB data	ICES-linked RPDB data	RPDB data (%)	ICES-linked RPDB data (%)
0-4	1,019	1,086	782	237	304	30.31	38.87
5-19	461	495	481	-20	14	-4.16	2.91
20-34	1,192	1,249	1,270	-78	-21	-6.14	-1.65
35-44	2,079	2,154	2,205	-126	-51	-5.71	-2.31
45-49	1,961	2,015	2,047	-86	-32	-4.20	-1.56
50-54	2,767	2,858	2,870	-103	-12	-3.59	-0.42
55-59	3,566	3,657	3,703	-137	-46	-3.70	-1.24
60-64	4,713	4,837	4,823	-110	14	-2.28	0.29
65-69	6,125	6,262	6,347	-222	-85	-3.50	-1.34
70-74	9,086	9,303	9,293	-207	10	-2.23	0.11
75-79	12,162	12,408	12,374	-212	34	-1.71	0.27
80-84	13,663	13,924	13,982	-319	-58	-2.28	-0.41
85-89	11,786	12,055	12,176	-390	-121	-3.20	-0.99
90+	11,154	11,372	11,478	-324	-106	-2.82	-0.92

*RPDB=Registered Persons Database, Ministry of Health and Long-Term Care
**ICES-linked RPDB=This data set links to Ontario administrative databases to create a yearly file with the most up-to-date geographic and death information.
***Ontario health planning data=Database maintained by MOHLTC containing death counts from the Ontario Registrar General (ORG) adjusted by Statistics Canada for deaths occurring outside Ontario.

Exhibit 12. The percent difference in deaths in RPDB* data, in ICES-linked RPDB** data, and in Ontario health planning data,*** by age group, 2003



*RPDB=Registered Persons Database, Ministry of Health and Long-Term Care
**ICES-linked RPDB=This data set links to Ontario administrative databases to create a yearly file with the most up-to-date geographic and death information.
***Ontario health planning data=Database maintained by MOHLTC containing death counts from the Ontario Registrar General (ORG) adjusted by Statistics Canada for deaths occurring outside Ontario.

RPDB death counts compared to Ontario death counts by sex in 2003

Key findings:

- Death counts for men and women were virtually the same in the RPDB data, the ICES-linked RPDB data, and in Ontario health planning data. *(See Exhibit 13.)*

Exhibit 13. The number of and percent difference in deaths in RPDB* data, in ICES-linked RPDB** data, and in Ontario health planning data,*** by sex, 2003

				Absolute difference compared to Ontario health planning death counts		Percent difference compared to Ontario health planning death counts	
Sex	**RPDB data**	**ICES-linked RPDB data**	**Ontario health planning data**	**RPDB data**	**ICES-linked RPDB data**	**RPDB data (%)**	**ICES-linked RPDB data (%)**
Female	40,391	41,339	41,486	-1,095	-147	-2.64	-0.35
Male	41,343	42,336	42,345	-1,002	-9	-2.37	-0.02

*RPDB=Registered Persons Database, Ministry of Health and Long-Term Care
**ICES-linked RPDB=This data set links to Ontario administrative databases to create a yearly file with the most up-to-date geographic and death information.
***Ontario health planning data=Database maintained by MOHLTC containing death counts from the Ontario Registrar General (ORG) adjusted by Statistics Canada for deaths occurring outside Ontario.

RPDB death counts and Ontario health planning data death counts by Local Health Integration Network (LHIN) in 2003

Key findings:

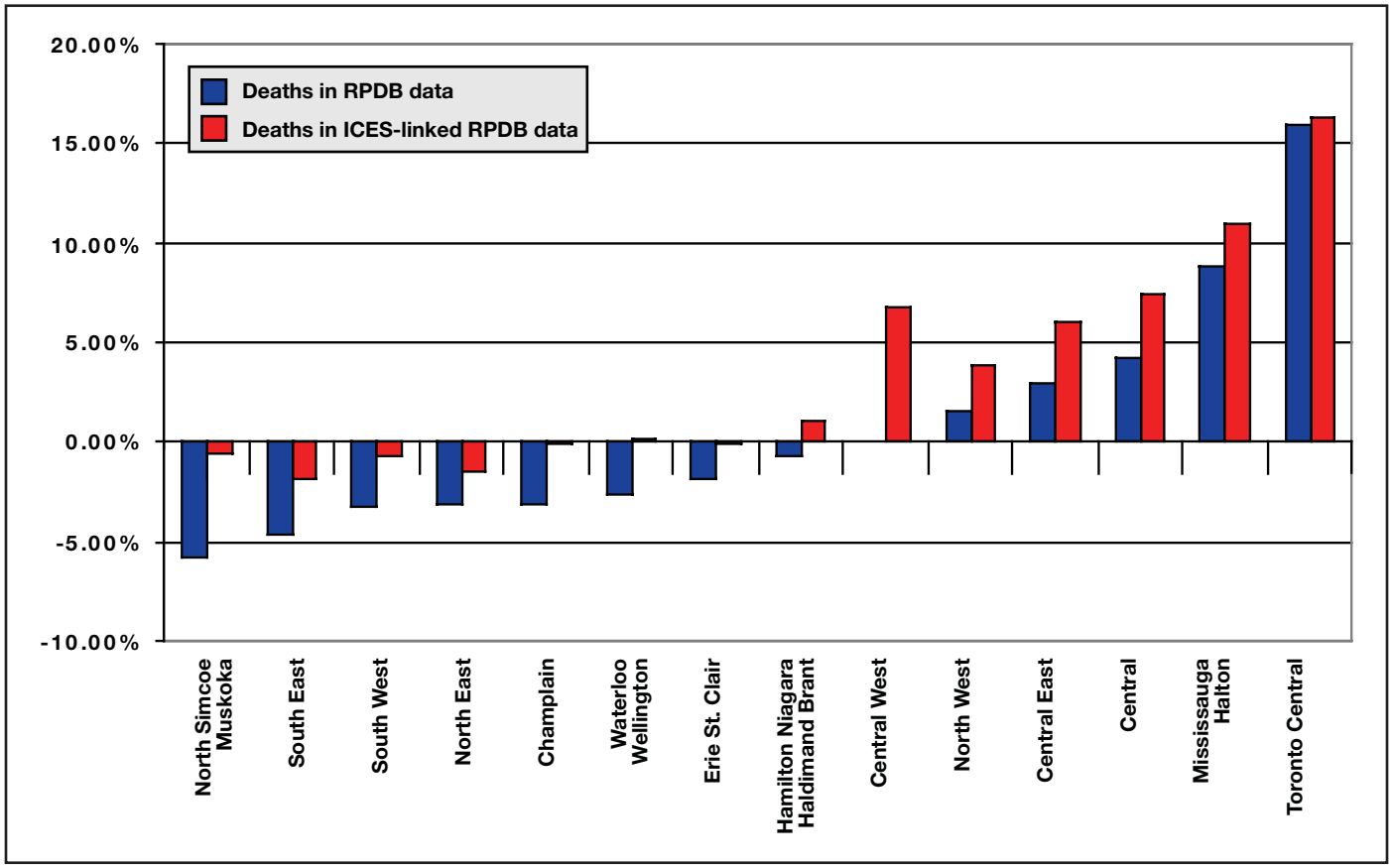
- Generally, in 2003, there were variations in death counts across the LHINs between the RPDB data and Ontario health planning data. *(See Exhibits 14 and 15.)*
- The RPDB data showed more deaths in the Toronto Central LHIN and in the LHINs surrounding Toronto compared to the number of deaths in the Ontario health planning data.
- The ICES-linked data flagged more deaths than the RPDB in the Toronto and surrounding LHINs and in the North West LHIN; the ICES-linked RPDB flagged fewer deaths than the RPDB in the other LHINs.
- Postal code information was either missing or invalid for approximately 3,000 persons whose deaths were reported in the Ontario health planning data. Previous reports have found that most of these postal code errors/omissions involved deceased Ontarians who had lived in the Toronto Central LHIN, in the four LHINs surrounding it (Central, Central East, Central West, Mississauga Halton), and in the North West LHIN.[9]
- This disparity in death counts across LHINs is probably due to the quality of geographic area information in the data sets, rather than problems with how the deaths were registered.

Exhibit 14. The number of and percent difference in deaths in RPDB* data, in ICES-linked RPDB* data, and in Ontario health planning data,* by Local Health Integration Network (LHIN), 2003**

				Absolute difference compared to Ontario health planning death counts		Percent difference compared to Ontario health planning death counts	
Local Health Integration Network (LHIN)	RPDB data	ICES-linked RPDB data	Ontario health planning data	RPDB data	ICES-linked RPDB data	RPDB data (%)	ICES-linked RPDB data (%)
North Simcoe Muskoka	3,019	3,189	3,207	-188	-18	-5.86	-0.56
South East	4,202	4,324	4,409	-207	-85	-4.69	-1.93
South West	7,504	7,701	7,759	-255	-58	-3.29	-0.75
North East	5,059	5,146	5,224	-165	-78	-3.16	-1.49
Champlain	7,663	7,899	7,910	-247	-11	-3.12	-0.14
Waterloo Wellington	4,104	4,223	4,215	-111	8	-2.63	0.19
Erie St. Clair	5,068	5,161	5,166	-98	-5	-1.90	-0.10
Hamilton Niagara Haldimand Brant	11,093	11,295	11,178	-85	117	-0.76	1.05
Central West	2,736	2,920	2,736	0	184	0.00	6.73
North West	2,063	2,107	2,030	33	77	1.63	3.79
Central East	9,123	9,392	8,858	265	534	2.99	6.03
Central	7,481	7,708	7,175	306	533	4.26	7.43
Mississauga Halton	4,580	4,667	4,207	373	460	8.87	10.93
Toronto Central	7,803	7,832	6,732	1,071	1,100	15.91	16.34
Missing or invalid postal code	236	111	3,025				

*RPDB=Registered Persons Database, Ministry of Health and Long-Term Care
**ICES-linked RPDB=This data set links to Ontario administrative databases to create a yearly file with the most up-to-date geographic and death information.
***Ontario health planning data=Database maintained by MOHLTC containing death counts from the Ontario Registrar General (ORG) adjusted by Statistics Canada for deaths occurring outside Ontario.
Note: Based on 2003 LHIN boundaries as defined by Ministry of Finance.

Exhibit 15. The percent difference in deaths in RPDB* data, in ICES-linked RPDB** data, and in Ontario health planning data,*** by Local Health Integration Network (LHIN), 2003



*RPDB=Registered Persons Database, Ministry of Health and Long-Term Care
**ICES-linked RPDB=This data set links to Ontario administrative databases to create a yearly file with the most up-to-date geographic and death information.
***Ontario health planning data=Database maintained by MOHLTC containing death counts from the Ontario Registrar General (ORG) adjusted by Statistics Canada for deaths occurring outside Ontario.
Note: Based on 2003 LHIN boundaries as defined by Ministry of Finance.

Discussion of death counts

The number of deaths observed across time, age and Local Health Integration Network (LHIN) varied across all the data sources used in our analysis.

In particular, the disparity between death counts among children in the RPDB data and in the Ontario health planning data requires much investigation and transparent discussion among data collectors and users. According to Statistics Canada, 25 percent of infant deaths in Ontario do not have a matching Vital Statistics birth record;[7] the correspondence between Ontario Vital Statistics registration for births and registration for deaths is unclear.

According to Statistics Canada, before adjustment 20 percent of Ontario postal codes in the Ontario Registrar General (ORG) death register were unusable, compared to three percent in Quebec and one percent in British Columbia in 2003.[9,11] In its 2004 Information Systems Plan,[10] the Vital Statistics Council for Canada called for the improvement of Vital Statistics geographic information. According to Statistics Canada reports, in the last few years, the ORG Vital Statistics death register has somewhat improved its capture of usable postal codes (12 percent unusable).[11,12]

Agreement between ICES-linked RPDB death data and Ontario health planning data was better in some LHINs and worse in others. According to a recent report,[9] the ORG Vital Statistics death counts appear to be undercounted by 22 percent in the Toronto and surrounding area LHINs (Central, Central East, Central West, Mississauga Halton and Toronto Central). However, it appears that such inaccuracies are probably caused by misallocation of people to geographic areas, rather than by faulty reporting of deaths.

One challenge in calculating death rates by geography is that a deceased person's health number is not collected by the ORG and listed on the corresponding death certificate. Thus, it may be difficult to confirm deaths in particular parts of the province.

Appraisal, Relevance and Opportunities

The results of our analysis suggest that information about how many people live and die in Ontario varies according to the data set used and also how the information is collected, organized and maintained.

We recommend that the RPDB be used cautiously by planners, decision makers and researchers for the following purposes:

- to conduct analyses by Local Health Integration Network (LHIN)
- to conduct other geography-based analyses, especially those involving Toronto and its surrounding areas
- to conduct analyses involving people aged 85 years and older
- to quantify and/or examine deaths in infants and children, particularly those under four years old

Our study has demonstrated that, in some cases, augmenting the RPDB with other sources of health services data can improve the usefulness of RPDB data. It is likely that a few modest changes in the system of collecting and tracking information about Ontarians will improve users' ability to utilize and rely on RPDB data and, by extension, to utilize and rely on other health system information.

We suggest the following changes to the current system:

- Updated address and other demographic information should be required for all Ontarians who are eligible for health care. The Ministry of Health and Long-Term Care is currently implementing such an initiative.
- Data elements that are collected to maintain the RPDB should be assessed for their potential use in improving the quality of the data for health planning. For example, organizations like ICES do not currently receive data regarding the status of individual Ontarians' health cards and other information that could produce better estimates regarding the number of persons eligible for health care in the province.
- When an Ontario resident dies, it would be useful to include the deceased person's health number on the corresponding provincial death record maintained by the Office of the Registrar General (ORG). This would enhance the accuracy of death count information in the RPDB and better serve efforts at health planning and evaluation.
- Paying greater attention to ensuring that complete and accurate postal code information is included on ORG Vital Statistics death certificates would greatly improve the quality of data currently used for health planning and evaluation.

Conclusion

The management of universal health care by Canadian provinces provides a wealth of population-based administrative databases that can be used for health policy, planning and research. The range and accuracy of these databases could be enhanced with some minor adjustments. A cooperative discussion among data custodians and users would greatly elevate the usefulness of health information which is so vital to improving Ontario's health care system.

Appendix A. Data Sources and Data Elements Used in This Analysis

Data set and purpose	Data source	Data organization and elements	Data used for this analysis
Registered Persons Database (RPDB) is a register of persons living in Ontario who are eligible for insured health care services	Ministry of Health and Long-Term Care	Organized in three files: • Eligibility file - encrypted health number* - start and stop dates of health care eligibility • Demographic file - encrypted health number* - date of birth - sex - death flag - date of death • Postal file - encrypted health number* - postal code - mailing or residence address designation - start and end date of geographic information	• All unique and valid encrypted health numbers associated with persons who are alive and eligible for health care on July 1 in each year from 1993 to 2003. • All unique and eligible encrypted health numbers associated with persons who died in each year from 1993 to 2003. NOTE: Local Health Integration Network (LHIN) designation for 2003 derived from postal code and dissemination area based on an ICES geographic look-up file.
ICES-linked RPDB (linked to administrative data**)		• health number* • ICES death flag by year** • death date** • date of last contact with health system** • date of birth • sex • ICES postal codes • city of residence** • dissemination area*** • LHIN designation***	RPDB linked to ICES administrative data** • Includes up-to-date: - postal code and death flag and date associated with health number in administrative data • Variables added: - date of last contact with health system - city of residence - dissemination area*** - LHIN*** designation NOTE: LHIN designation for 2003 derived by using updated postal code, city of patient residence and dissemination area.

Data set and purpose	Data source	Data organization and elements	Data used for this analysis
Population estimates by year for each LHIN	Statistics Canada and the Ministry of Health and Long-Term Care	• year • LHIN designation • age • sex • number of people	Population counts for each year (age and sex) by LHIN from 1993 to 2003 NOTE: LHIN boundaries for 2003 previously derived by Ontario Ministry of Finance based on census sub-divisions.
Ontario death counts by year and five-year age groupings for each LHIN Special data cut February 2007	Ontario health planning database, Ministry of Health and Long-Term Care	• year • LHIN designation • five-year age groups • sex • number of deaths	Death counts for five-year age groupings by year, sex and LHIN. NOTE: LHIN boundaries for 2003 previously derived by Ontario Ministry of Finance based on census sub-divisions.

*Encrypted at ICES
**Linked by encrypted health number to: the hospital discharge abstracts (DAD); the National Ambulatory Care Reporting System (NACRS); Continuing Care Reporting System (CCRS); Levels of Care Classification System (LOC); and National Rehabilitation System (NRS).
***Geographic area as defined by Statistics Canada
Note: LHIN boundaries as defined by Ministry of Finance for years following 2001.

Appendix B. How the Research was Done

Population counts

According to ICES privacy practices, the unique health numbers from the Ministry of Health and Long-Term Care (MOHLTC) were stripped from the Registered Persons Database (RPDB) and replaced with corresponding unique encrypted numbers used across all ICES administrative data sets.

For this analysis, the count of people eligible for health care in Ontario was defined as the number of unique and encrypted numbers (as a proxy for eligible people) in the RPDB and in the ICES-linked RPDB. This count was compared to Statistics Canada population estimates. Persons whose records showed a postal code correlating to an address outside Ontario were excluded from the analysis. These included records for 40,046 unique encrypted numbers in the RPDB and records for 35,479 unique encrypted numbers in the ICES-linked RPDB.

Data about Ontarians deemed eligible for health care on July 1 for each year from 1993 to 2003 were extracted in order to be consistent with Statistics Canada population estimates. Age was determined as of July 1 in each year. Age was aggregated into five-year groupings (ages 0–4 years; ages 5–9 years, etc.) up to age 90–105 years. A further data adjustment was made by excluding persons aged 90–105 who did not show contact with the health care system prior to July 1, 1993 according to linked administrative data sets (i.e., if a very elderly adult had no contact in the ten years prior to July 1, 2003, he/she was considered to be dead or living outside of Ontario and was thus removed from the cohort).

For each unique encrypted number, the address postal code was assigned for each year based on the start and end dates in the RPDB address file, with residential address type taking priority over mailing address. The postal code was converted to dissemination area (DA) and dissemination block using the Statistics Canada Postal Code Conversion File (PCCF+). Each unique encrypted number (representing an eligible person) was mapped to the Local Health Integration Network (LHIN) in which the person lived. The data of July 1 was used as a reference point for the postal codes for each year.

For the ICES-linked RPDB, the address information in the RPDB was supplemented by additional geographic postal codes and city of residence codes (also known as “rescodes”) from the ICES administrative data holdings. The resulting data set included the most credible geographic information.

Each year, from 1993 to 2003, the number of eligible persons identified in the RPDB and the ICES-linked RPDB was compared to Statistics Canada population estimates. The same comparison was made by age, sex and LHIN designation for the year 2003.

Death counts

The number of deaths identified in the RPDB and the ICES-linked RPDB were compared to death counts in the health planning database used by the MOHLTC. All deaths were considered for each year. Persons with a postal code outside Ontario were excluded from the analysis (about 60 records in the RPDB). Age identified in the RPDB on July 1 of each year was calculated from birth date. Age was aggregated as: 0–4 years, 5–19 years, 20–34 years and 35–44 years (to avoid small cell sizes). Thereafter, age was aggregated into five-year age groupings to 90 years; deaths for persons ages 90 to 105 were grouped together.

Deaths identified in the Ontario health planning data (that includes Ontario Registrar General Vital Statistics death data and Statistics Canada death data) were counted from 1993 to 2003 and by age, sex and LHIN for the year 2003. Almost 600 records were excluded from the LHIN analysis due to out-of-province postal codes (data not shown).

Each year from 1993 to 2003, the number of persons who died, as identified in the RPDB and the ICES-linked RPDB, was compared to the number of deaths in the Ontario health planning data. The same comparisons were made by age, sex and LHIN designation for the year 2003.

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