Life Expectancy at Birth at the Local Level in Ontario

D.G. Manuel, MD, MSc,¹ V. Goel, MD, MSc, FRCPC,^{2,3} J.I. Williams, PhD³

Life expectancy is arguably the most recognized indicator of population health. Estimates have been reported for centuries, during which the methods of life table derivation have been refined and incorporated as one of a demographer's most useful tools.

Increasingly, health planners and epidemiologists are asked to produce local level health status reports. However, life expectancy has frequently disappeared from such reports (in Ontario we are aware of only two Health Units that have estimated their life expectancy; notable exceptions include several other provincial reports¹⁻³). Other applications of life tables are virtually absent in local health planning.⁴ There may be many barriers to local reporting of life expectancy, including difficulties in its derivation (data availability, methodological constraints, and lack of resources), the more common use of standardized mortality rates/ratios, and the perceived diminished value as a health outcome measure. The latter may result in part from: the search for health status measures that more closely reflect a comprehensive positive view of health (and not merely mortality); the false assumption that life expectancy has plateaued in the latter half of this century; and, the perception that life expectancy differences

between populations are small and of little significance. Although the difference in life expectancy between provinces has narrowed to less than 1.7 years for males and 2.4 years for females,⁵ the degree of variability at the local level is less clearly established.

This paper presents the results of life expectancy for the 42 Health Units (HU) in Ontario for 1988-1992.

METHODS

Our methods for deriving life expectancy at the local level have been described in detail previously⁶ and are briefly reviewed here. Ontario Registrar General's mortality files for 1988-1992 and 1990 Statistics Canada corrected population estimates

were used to construct life tables. The unit of analysis was Ontario's 42 Health Units (population range 40,000 - 680,000) which are primarily amalgamations of counties (Census Divisions), except the Metropolitan Toronto municipalities (Census Subdivisions). Municipal geographic coding was performed by the provincial vital statistics registry from street and municipal addresses. Five years of death registration data, as opposed to the three years that are generally used for most provincial life tables, were combined to increase statistical power. There were 358,490 deaths in Ontario between 1988-1992 (range for HU 1,980 to 29,671). Individual records were then aggregated by the 42 Health Units, gender, and the 19 age groups usually used for calculating

Figure 1. Life Expectancy at Birth by PHU, 1988-1992
Note: Each triangle represents one Public Health Unit (PHU). Statistical testing is between the PHU and the Ontario mean.

1. Community Medicine Residency Program, University of Toronto, ON
2. Department of Public Health Sciences, University of Toronto, ON
3. Institute for Clinical Evaluative Sciences, North York, ON

Correspondence and reprint requests: Dr. Vivek Goel, Department of Public Health Sciences, 4th Floor, McMurich Building, University of Toronto, Toronto, ON, M5S 1A8, Tel: 416-978-7550, Fax: 416-978-5442

Dr. Goel is supported in part by a National Health Scholar Award from Health Canada.

Figure 2. Life Expectancy at Birth for Males by PHU, Ontario 1988-1992

abridged life tables (<1, 1-4, 5-9,..., 85+ years).

Chiang's method⁷ of life table construction was used to estimate both life expectancy estimates and statistical variance. (The authors' spreadsheet program used to derive the life tables is available at <http://www.cehip.org> in the "Health Data" section.) For the age group 85+ years we used a uniform probability of death for all Health Units to reduce potentially wide differences in life expectancy estimates between Health Units that may result from Chiang's method.

Student's t-test was used to test statistical difference between the Ontario mean and the individual Health Units. $P < 0.0005$ was considered statistically significant using the principle of Bonferroni correction of multiple comparisons ($P = 0.05 / \sim 100$ comparisons = 0.0005).⁸

RESULTS

The distribution of life expectancy at birth in the 42 Health Units in Ontario is shown in Figure 1. For males the range in life expectancy is 6.0 years (71.2 to 77.2 years) and 4.3 years for females (76.9 to 82.6). Generally, northern and rural Health Units had the lowest life expectancy estimates (Figure 2).

Statistical variation in life expectancy at birth was small with the standard error ranging from 0.13 to 0.40 for the Health Units. In total, 30 Health Units had life expectancy estimates for males significantly ($p < 0.0005$) different from the Ontario mean (26 Health Units for females).

DISCUSSION

Life expectancy at birth remains an excellent summary indicator of overall public health. Local area estimates are easily derived by well-established methods and accessible local data. Our estimation of life expectancy for Health Units in Ontario indicate that, contrary to popular belief, it is a sensitive summary measure for comparison of health between local areas. The differences at the local level in Ontario are over three times larger than the differences observed between provinces, and most local estimates are significantly different from the Ontario mean. We did not examine whether local life expectancy is responsive to changes over time but others have noted it is for large populations;⁹ these results are certainly pertinent for local comparison.

A major potential source of error in the derivation of life expectancy at the local level is miscoding the place of residence

and migration of elderly into long-term care facilities close to the time of death. We were unable to show that these sources of error accounted for the large statistical differences between Health Units. The City of Toronto likely had the largest miscoding error in Ontario due to its close proximity to five neighbouring municipalities within Metropolitan Toronto. Direct validation of individual death certificates in 1994 found approximately 10% of deaths were attributable to the neighbouring municipalities (personal communication, F. Goettler, 1996). While elderly migration may be important in some parts of Canada, there are insufficient data on this for its impact to be assessed in Ontario.

The most important public health observation from our analysis is the large difference in overall mortality between local areas. Life expectancy is the indicator of choice to deliver this message to the general public. Other mortality indicators such as directly standardized mortality rates do not have life expectancy's ubiquitous and intuitive understanding. Further advantages over other indicators include the avoidance of an arbitrary reference population and the availability of other recognized indicators derived from life tables such as the life-time probability of developing a condition and cause-deleted life expectancy. Miscoding the place of residence will result in the greatest error but applies to most health indicators at the local level, including all mortality indicators that use the Registrar General's mortality files. For those who prefer a positive indicator of health, life tables can be combined with a health-related quality of life measure to generate health expectancy.¹⁰

REFERENCES

1. Choiniere R, Pageau M, Ferland M, et al. Mortality in Quebec. Presented at the Canadian Public Health Association 88th Annual Conference; Halifax, 1997.
2. Alberta Health. Report on the Health of Albertans. Edmonton: Alberta Health, 1996.
3. British Columbia Provincial Health Officer. A report on the health of British Columbians: Provincial Health Officer's Annual Report 1996. Victoria, BC: Ministry of Health and Ministry Responsible for Seniors, 1996.
4. Péron Y, Strohmneger C. Demographic and Health Indicators - Presentation and Interpretation. Ottawa: Statistics Canada 82-543E; 1992.

5. Statistics Canada. Life Tables, Canada and the Provinces, 1990-1992. Occasional: Catalogue 84-537; 1995.
6. Manuel D, Goel V, Williams J. The derivation of life expectancy at the local level. *CDIC* 1998;19(2):52-56.
7. Chiang CL. *The Life Table and Its Applications*. Malabar, Florida: Robert E. Krieger Publ. Co., 1984.
8. Jones D, Rushton L. Simultaneous inference in epidemiologic studies. *Int J Epidemiol* 1982;11:276-82.
9. Chenet L, Olser M, McKee M, Krasnik A. Changing life expectancy in the 1980s: Why was

- Denmark different from Sweden? *J Epidemiol Commun Health* 1996;50:404-7.
10. Wolfson M. Health-adjusted life expectancy. *Health Rep* 1996;8(1):41-45.

Received: April 9, 1998
Accepted: September 4, 1998

COMING EVENTS ACTIVITÉS À VENIR

To be assured of publication in the next issue, announcements should be received by **March 15, 1999** and valid as of **April 30, 1999**.
Announcements received after **March 15, 1999** will be inserted as time and space permit.
Pour être publiés dans le prochain numéro, les avis doivent parvenir à la rédaction avant le **15 mars 1999** et être valables à compter du **30 avril 1999**. Les avis reçus après le **15 mars 1999** seront insérés si le temps et l'espace le permettent.

The Evidence for Evidence: Getting Value for Money in Economic Evaluations of Health and Health Care
29-30 April 1999
Shaw Conference Centre Edmonton, AB
Organized by the Institute of Pharmaco-Economics
Contact:
Joseph Gebran
Institute of Pharmaco-Economics
Suite 710, 10665 Jasper Avenue
Edmonton, AB T5J 3S9
Tel: 403-448-4881 Fax: 403-448-0018
E-mail: jgebran@ipe.ab.ca

The Shifting Epidemic: Research Directions for the New Millennium/ L'épidémie en transformation : orientation de la recherche en vue du nouveau millénaire
Eighth Annual Canadian Conference on HIV/AIDS Research/ VIII^e Conférence canadienne annuelle de recherche sur le VIH/SIDA
Organized by the Canadian Association for HIV Research/ Organisé par l'Association canadienne de recherche sur le VIH
1-4 May/mai 1999 Victoria, BC
Contact/Contacter :
Conference Secretariat/Secrétariat
CAHR Conference/Conférence de l'ACRV
c/o BC Centre for Excellence in HIV/AIDS
6th Floor Burrard Building
St. Paul's Hospital, 1081 Burrard St.
Vancouver, BC V6Z 1Y6

The 10th Global Warming International Conference & Expo
Climate, Environment and Health for the 21st Century
5-8 May 1999
Mt. Fuji, Fujiyoshida Yamanashi, Japan
Convened by the Global Warming International Center, and the Yamanashi Institute of Environmental Sciences, Japan
Registration deadline: 1 March 1999
Contact:
GW10 Conference Registration
SUPCON, P.O. Box 5275
Woodridge, IL 60517-0275 USA
Fax: 630-910-1561

Healthy People and Healthy Communities: A Canada - United States Dialogue on Best Practices in Public Health
Hosted by the Canada West Foundation
8-9 May 1999 Royal York Hotel, Toronto, ON
This conference is designed to promote a sharing of successful contemporary Canadian and American experiences in best practices in public health. The comparative dimension of the conference will be addressed through the dialogue of American and

Canadian participants, and through the bi-national structure of the conference.
The intended audience is health practitioners, public policy analysts, policy makers and health administrators who deliver healthcare services and/or develop health policies.
Four themes will be addressed at the conference:
Integrating preventive medicine; Pushing the boundaries; Outcomes; Ethics of health care
Contact:
Carey Hill, Conference Organizer
Healthy People and Healthy Communities
The Canada West Foundation
550, 630 3rd Avenue SW, Calgary, AB T2P 4L4
Tel: 403-264-9335 Fax: 403-269-4776
E-mail: hill@cwf.ca

The First Canadian Conference on Shaken Baby Syndrome
Awareness, Prevention and Response: An Integrated Approach
Organized by the Saskatchewan Institute on Prevention of Handicaps
26-29 May 1999 Saskatoon, SK
Contact:
Saskatchewan Institute on Prevention of Handicaps
1319 Colony Street, Saskatoon, SK S7N 2Z1
Tel: 306-655-2512 Fax: 306-655-2511
E-mail: skiph@sk.sympatico.ca

Meeting the Health Care Challenges in the Next Millennium: Expanding Roles of Nurses
Organized by the School of Nursing, Dalhousie University
28 May 1999 Halifax, NS
Contact:
School of Nursing, Dalhousie University
Tel: 902-494-2535 Fax: 902-494-3487
E-mail: julia.wong@dal.ca
http://lis.dal.ca/~son/main/nursing.htm

Public Health in the New Millennium/ La santé publique au prochain millénaire
CPHA's 90th Annual Conference/90^e conférence annuelle de l'ACSP
6-9 June/juin 1999 Winnipeg, MB
Contact/Contacter :
CPHA Conference Department/
Service des conférences ACSP
400 - 1565 avenue Carling Avenue
Ottawa, ON K1Z 8R1
Tel: 613-725-3769 Fax/Télé.: 613-725-9826
E-mail/Courriel électr. : conferences@cpha.ca
www.cpha.ca

École d'été - ISPED 99
Santé publique, épidémiologie et développement - Méthodes et techniques
7-9 juin 1999
Pré-inscription avant le 15 avril 1999, inscription définitive 22 avril 1999
Contacteur :
Evelyne Mouillet
Centre de Documentation
ISPED - INSERM U 330
Université Victor Segalen Bordeaux 2
146 rue Leo Saignat
33076 BORDEAUX Cedex FRANCE
C. électr. : evelyne.mouillet@dim.u-bordeaux2.fr
www.isped.u-bordeaux2.fr

Conférence internationale francophone en sciences de la santé
La pratique et la formation des professionnels de la santé en réponse aux besoins des individus et des communautés
26-29 juin 1999 Moncton, N-B
Co-parrainée par l'Organisation mondiale de la santé, le Programme de formation médicale francophone du N-B; l'Université de Sherbrooke, Faculté de médecine; et l'Institut international des soins infirmiers du Canada
Contacteur :
Secrétariat Conférence Acadie-Sherbrooke 1999
C.P. 946, Moncton, N-B E1C 8N8
Tél : 506-861-6341 ou 1-800-974-7070
Télé.: 506-855-1646
Courriel : secretariat@confacadie-sherbrooke.org

AIDS IMPACT
Biopsychosocial Aspects of HIV Infection
4th International Conference
Connecting a World of Resources
15-18 July 1999 Ottawa, ON
Hosted by the Canadian Psychological Association (CPA)
AIDS IMPACT provides a multidisciplinary forum where researchers, care providers, consumers and others can address changing trends in the HIV epidemic. The conference aims to bring research to practice by delivering expertise and skills to the front lines.
Contact:
AIDS Impact 1999 Secretariat
151 Slater Street, Suite 205
Ottawa, ON K1P 5H3
Tel: 613-237-2144 Fax: 613-825-0530
Web site: www.aidsimpact.com

World Conference on Breast Cancer
An international and multi-disciplinary forum where all the issues around breast cancer can be addressed.
26-31 July 1999 Ottawa, ON
Contact:
World Conference on Breast Cancer
841 Princess St.
Kingston, ON K7L 1G7
Tel: 613-549-1118 Fax: 613-549-1146
E-mail: brcancer@kos.net