The use of potential years of life lost for monitoring premature mortality from chronic diseases: Canadian perspectives

Katerina Maximova, PhD,¹ Shahriar Rozen, MPH,^{1,2} Jane Springett, PhD,^{1,2} Sylvie Stachenko, MD, MSc, FCFP^{1,2}

ABSTRACT

Given that chronic diseases account for 88% of all deaths in Canada, robust surveillance and monitoring systems are essential for supporting implementation of health promotion and chronic disease prevention policies. Canada has a long tradition of monitoring premature mortality expressed as potential years of life lost (PYLL), dating back to the seminal work by Romeder and McWhinnie in the late 1970s, who pioneered the use of PYLL as a tool in health planning and decision-making. The utility of PYLL for monitoring progress was expanded in the 1990s through the national comparable Health Indicators Initiative, following which PYLL has been monitored for several decades nationally, provincially, regionally and locally as part of health systems' performance measurement. Yet the potential for using PYLL in health promotion and chronic disease prevention has not been maximized. Linking PYLL with public health programs and initiatives aimed at health promotion and chronic disease prevention, introduced starting in the 1990s, would inform whether these efforts are making progress in addressing the burden of premature mortality from chronic diseases. Promoting the use of PYLL due to chronic diseases would contribute toward providing a more complete picture of chronic diseases in Canada.

KEY WORDS: Potential years of life lost; chronic disease prevention; health promotion; Canada; burden of disease

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P remature mortality undermines national efforts to increase life expectancy and adversely affects the country's economic growth as a result of lost productivity, and it is a major consideration when evaluating the impact of chronic, noncommunicable diseases (NCD) on a population. Strong surveillance and monitoring systems are essential for determining whether public health programs, practices, policies and interventions aimed at health promotion and chronic disease prevention are making progress in reducing the burden of premature mortality from chronic diseases. Member States of the World Health Organization (WHO) have committed themselves to establishing robust NCD surveillance systems to monitor progress toward achieving the global targets set out in the Global Action Plan for the Prevention and Control of NCD 2013–2020.¹ A 25% reduction in premature NCD mortality by 2025 has been adopted globally as the overarching target to support action on health promotion and chronic disease prevention.² This is to be measured by a new indicator based on the probability of dying between the ages of 30 and 70 years from four major chronic diseases (cardiovascular disease, cancer, chronic respiratory disease and diabetes).² However, other well-established measures of premature mortality exist and have a long tradition in Canada.

As a measure of premature mortality, potential years of life lost (PYLL or YPLL, years of potential life lost) involves estimating the average years a person would have lived if she/he had not died prematurely, thus emphasizing deaths that occur at younger ages. The cut-off age, defined in terms of deaths occurring before the average life expectancy, is commonly set at age 75 years in Canada and is higher than in most OECD (Organisation for Economic Co-operation and Development) countries. This cut-off can be

justified, given that life expectancy at birth is higher in Canada (79 years for males and 83 years for females) than in many other countries. However, aligning the PYLL methodology with the global focus on premature mortality before age 70 years would enable monitoring of Canada's progress in a way consistent with the global targets for chronic disease prevention and control,^{1,2} and facilitate comparisons with other countries.

Dating back to Petty's *Political Arithmetic* (1687) and Dublin and Lotka's *The Money Value of a Man*,³ the concept of PYLL was first applied in the health sector in the 1940s to rank different causes of death in the US.^{4,5} Yet it was Canada that pioneered the use of PYLL as a tool in health planning and progress monitoring in the late 1970s. In their seminal work, Romeder and McWhinnie compared the relative importance of major causes of premature mortality before age 70 years nationally and provincially using PYLL.⁶ In the late 1980s, another team of Canadian researchers illustrated the relevance of PYLL for public health, with a particular emphasis on prevention of premature deaths from chronic diseases.⁷ Wigle and colleagues showed that of almost 100,000 premature deaths in 1986, equivalent to over 1.7 million PYLL or 17.8 years of life lost per person, more than half were preventable through control of

Author Affiliations

1. School of Public Health, University of Alberta, Edmonton, AB

2. Centre for Health Promotion Studies, University of Alberta, Edmonton, AB

Correspondence: Katerina Maximova, PhD, School of Public Health, University of Alberta, 3-268 Edmonton Clinic Health Academy, Edmonton, AB T6G 2T4, Tel: 780-248-2076, E-mail: katerina.maximova@ualberta.ca

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underlying risk factors for chronic disease (smoking, hypertension, elevated cholesterol, diabetes and alcohol abuse).⁷

It is not a coincidence that this work occurred at a pivotal time for public health in Canada, when the development of new, social indicators was needed to support the broadened focus on health promotion and primary prevention of chronic disease. Canada's leadership on this front is embodied in the 1986 *Ottawa Charter for Health Promotion*⁸ and its Canadian sister *Achieving Health for All: A Framework for Health Promotion*,⁹ known as the Epp Report, which are recognized as foundational to modern public health policy and practice. With its simplicity of calculation and ease of comprehension, PYLL was advocated at that time as an evaluation tool to support the implementation of national, provincial and regional health promotion and chronic disease prevention policies.

The utility of PYLL for monitoring progress was expanded in the 1990s through the national, comparable Health Indicators Initiative. PYLL before age 75 years due to all causes and select preventable causes (i.e., cardiovascular disease, cancer, respiratory diseases, unintentional injuries, suicide, AIDS) was included in the initial core set of 37 indicators of the 1999 Health Indicators Framework and in the updated 2013 Health System Performance Measurement Framework, which is recognized internationally as one of the most robust health system performance measurement tools.¹⁰ Since then, PYLL due to all causes and to potentially avoidable causes (comprising preventable and treatable causes) has been monitored routinely as part of health system's performance assessment at the national, provincial/territorial, regional and local levels. A handful of Canadian studies have examined PYLL due to alcohol- and smoking-related causes¹¹ and have profiled large differentials in premature mortality from intentional and unintentional injuries in Aboriginal populations.¹²

Despite the relevance of PYLL for demonstrating the impact of public health efforts in health promotion and disease prevention, the potential for using premature mortality from chronic diseases, expressed as PYLL, has not been maximized to evaluate the link with wide-reaching health promotion or chronic disease prevention programs and initiatives introduced in Canada starting in the 1990s at the provincial or national levels (e.g., Pan-Canadian Healthy Living strategy, Quebec Plan d'action gouvernemental de promotion des saines habitudes de vie, ActNow BC and Ontario's Action Plan for Healthy Eating and Active Living, Canadian Heart Health Initiative, Canadian Population Health initiative). The use of PYLL has been hampered for several reasons.

First, despite the growing need for epidemiological methods to support increasing evidence-based public health policy and planning, PYLL has not been integrated into undergraduate medical curricula or graduate epidemiology courses.¹³ The epidemiological methods, as covered in contemporary textbooks, emphasize etiological inquiry and fall short of providing the tools for assessing the relative magnitude of public health problems or setting public health priorities.¹⁴

Second, the expanded focus on comprehensive approaches to chronic disease prevention and control required new methodological tools to address the effects of both disability and premature death. Globally, the disability adjusted life years (DALY) emerged as the prime measure of the chronic disease burden¹⁵ and

superseded the use of PYLL in chronic disease prevention. Since chronic diseases have an important morbidity component, DALY was developed through the Global Burden of Disease initiative by the WHO to take into account the loss of healthy life years due to disability or poor health.¹⁶ DALY combines years of life lost to premature death (YLL) with years lived with a disability or health condition (YLD). YLD is weighted for the severity of a condition by the so-called disability weights, which reflect the relative reduction in health-related quality of life.¹⁷ The quality of YLD estimates directly depends on the underlying assumptions about the disability weights and the availability of nationally representative, complete, consistent and comparable incidence or prevalence data.^{16,18} Large variations in methodological choices around the underlying assumptions and the quality of epidemiological data render it difficult to assess whether differences in DALY estimates are due to actual differences in population health.¹⁸

The conceptual and methodological framework underlying DALY has been heavily criticized with regard to the choice of assumptions, particularly the disability weights, and underwent its first major revision in 2012.^{17,18} However, the key weakness around the determination of disability weights in the calculation of YLD remains controversial and is the chief reason why a recent Canada-based assessment of the revised methodology suggested that the utility of DALY for guiding public health policy is limited at best.¹⁷ While DALY remains the choice indicator at the international level, in Canada DALY was not included in the set of comparable health indicators and therefore has not been routinely monitored.¹⁰ Overcoming methodological challenges remains a critical issue before DALY can be more widely used in health promotion and chronic disease prevention.¹⁶

In the meantime, the criticisms that pertained to YLL calculation have been adequately addressed: 1) the use of different age weightings for YLL at different ages was made uniform; 2) the use of different life expectancies for men and women was made uniform; and 3) the use of discounting, assigning lower weights to YLL in the future, was abolished.¹⁸ Given the simplicity of calculation and ease of comprehension, the YLL component of DALY offers an opportunity to advance public health policy in health promotion and chronic disease prevention and thus contribute to assessing the progress of public health interventions. Such information would allow public health programs, practices, policies and interventions directed at health promotion and chronic disease prevention to be judged both in terms of cost-effectiveness and impact on reducing the burden of premature mortality at the population level. Given the availability of digitalized, high-quality mortality data by cause of death at the national, provincial/territorial and regional levels from the 1970s, promoting the use of PYLL due to chronic diseases alongside new indicators of premature chronic disease mortality, developed through the Global NCD Action Plan,^{1,2} would improve capacity to provide a more complete picture of trends in premature chronic disease mortality in relation to public health efforts. Furthermore, this would contribute to building a comprehensive chronic disease surveillance system to monitor progress toward achieving national and global public health policy goals to reduce premature mortality from chronic diseases.

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RÉSUMÉ

Étant donné que les maladies chroniques sont à l'origine de 88 % des décès au Canada, il est essentiel d'avoir des systèmes de surveillance et de contrôle robustes pour appuyer la mise en œuvre des politiques de promotion de la santé et de prévention des maladies chroniques. Le Canada a une longue tradition de surveillance de la mortalité prématurée, exprimée en années potentielles de vie perdues (APVP); cette tradition remonte aux travaux phares de Romeder et McWhinnie qui, à la fin des années 1970, ont été les pionniers de l'utilisation des APVP comme outil de planification sanitaire et de prise de décision. L'utilité des APVP pour faire le suivi des progrès réalisés s'est accrue dans les années 1990 avec l'initiative nationale des Indicateurs comparables de la santé, depuis laquelle on suit les APVP au pays à l'échelle provinciale, régionale et locale lorsqu'on mesure le rendement des systèmes de santé. Pourtant, les possibilités d'utilisation des APVP pour la promotion de la santé et la prévention des maladies chroniques ne sont pas pleinement exploitées. Le maillage des APVP avec des programmes et initiatives de santé publique introduits dans les années 1990 pour promouvoir la santé et prévenir les maladies chroniques permettrait de savoir si ces efforts progressent vers l'allègement du fardeau de la mortalité prématurée due aux maladies chroniques. Promouvoir l'utilisation des APVP en raison des maladies chroniques contribuerait à dessiner un portrait plus détaillé des maladies chroniques au Canada.

MOTS CLÉS : années potentielles de vie perdues; prévention des maladies chroniques; promotion de la santé; le Canada; charge de morbidité