Socioeconomic inequalities in mortality at older ages in Quebec (Canada): Perspectives from the modal age at death

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EXTENDED ABSTRACT

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Abstract

Previous studies showed important differences in adult mortality according to the socioeconomic status of individuals, revealing that the level of education, type of occupation, and level of income have huge impacts on health and mortality. However, few studies addressed this issue in old-age mortality specifically. In this paper, we use a recently proposed method to investigate whether changes in the modal age at death and in the mortality dispersion above this age vary along the levels of deprivation within a population. We rely on the method of P-splines, a nonparametric approach, to smooth mortality data for each quintile of deprivation and then estimate the modal age at death and the mortality dispersion above that age. Using data for Quebec (Canada) for periods 2000-2002 and 2005-2007, we show that inequality according to the deprivation index persist, in particular among Quebec men, beyond the age where premature mortality occurs.

Introduction

Many studies have shown important differences in adult mortality according to the socioeconomic status of individuals, revealing that the level of education, the type of occupation or the level of income have a huge impact on health and mortality (Wilkinson and Marmot, 2003). However, few studies addressed this issue in the case of old-age mortality specifically. Recent work by Brown et al. (forthcoming) investigated educational disparities in longevity and mortality compression at older ages in the United States. Their estimations of the modal age at death and dispersion above that age relied on the parametric approach of Kannisto (2001). In this study, we take advantage of a newly proposed method in the field of mortality, namely P-splines, to uncover whether changes in the modal age at death and in the mortality dispersion at older ages vary according to the different level of deprivation in Quebec (Canada).

Deprivation takes many forms and involves, for example, having few family assets, low education level, living in poor housing and so on. For Townsend (1987), deprivation is "a state of observable and demonstrable disadvantage relative to the local community or the wider society or nation to which an individual, family or group belongs". Based on this definition, Pampalon and Raymond (2000) developed a deprivation index, specifically tailored for the Quebec (Canada) population, which tackles two kinds of deprivation: material and social. The index aims at segmenting the population into five groups (or quintiles), each accounting for 20% of the female or male total population.

In this paper, we take advantage of both this deprivation index and an innovative method based on P-splines to uncover socioeconomic inequalities in mortality at older ages in Quebec (Canada). Specifically, we use the method proposed by Ouellette and Bourbeau (2011) to estimate and compare modal age at death values and standard deviation of individual life durations for those reaching that age along the various socioeconomic segments of the population.

Data and Methods

We obtained observed death counts D_x by sex and single year of age from the Quebec National Institute of Public Health (*Institut national de santé publique du Québec*) for periods 2000-2002 and 2005-2007. We also obtained mid-year population estimates E_x for years 2001 and 2006 (years of Canadian census) by sex and single year of age. Most importantly, both death counts and exposure to risk data were available by corresponding deprivation quintile.

As a first step, for each period, sex and deprivation quintile (materiel and social dimensions combined) corresponding to a socioeconomic subgroup of the population, we will estimate the age-at-death distribution using the nonparametric P-splines smoothing approach presented by Ouellette and Bourbeau (2011). Then, from these smoothed age-at-death distribution, we will estimate the modal age at death ($\widehat{M}$) and the dispersion of deaths above the mode ($\widehat{SD(\mathrm{M}+)}$). Finally, we will build bootstrap confidence intervals for these estimates in order to facilitate the comparison of results along the various subgroups of the population. The *residual bootstrap*

method developed by Koissi et al. (2006), adapted to the context of P-spline smoothing, will be used to compute these confidence intervals.

Preliminary Results

Figure 1 suggests that there are no statistical significant differences (at the 95% level) in modal age at death along the various socioeconomic subgroups of the female Quebec population in 2000-2002 and in 2005-2007. However, for each quintile, important increases occurred between the two periods. Figure 2 displays the smoothed age-at-death distributions and illustrates well the disadvantage of the most deprived (Q5) compared to other subgroups of the female population of Quebec at the ages of premature mortality. This disadvantage is present in both periods under review. While the distribution of deaths by age of the most advantaged quintile (Q1) seems to have moved, albeit marginally, towards older ages, other distributions remained practically unchanged between 2000-2002 and 2005-2007. Between the two periods, the dispersion of life spans beyond the modal age at death, reflecting a higher concentration of deaths at this age, decreased for each of the quintiles with the exception of most deprived (Q5), where there is a slight increase (see Table 1). However, this increase in time, although slight, seems significant only for quintile 4.

Among men, socioeconomic disparities in mortality are particularly important between the most (Q1) and least (Q5) favored subgroups (see Figure 3). Smoothed age-at-death distributions in Figure 4 show that most disadvantaged men (Q5) have a significantly higher premature mortality than men in every other deprivation quintile, and this finding holds for both periods under review. Moreover, there is a clear shift of the male age-at-death distributions towards older ages between 2000-2002 and 2005-2007, regardless of their level of deprivation. However, unlike their female counterparts, old-age mortality compression of mortality may still be ongoing (see Table 1). Indeed, between the two periods under study, the dispersion of life spans beyond the modal age at death decreased for almost all quintiles. Only in the subgroup of the most deprived male population (Q5) did a slight increase occur.

Figure 1: Modal age at death and 95% confidence intervals by deprivation quintile (material and social combined), females, Quebec, 2000-2002 and 2005-2007

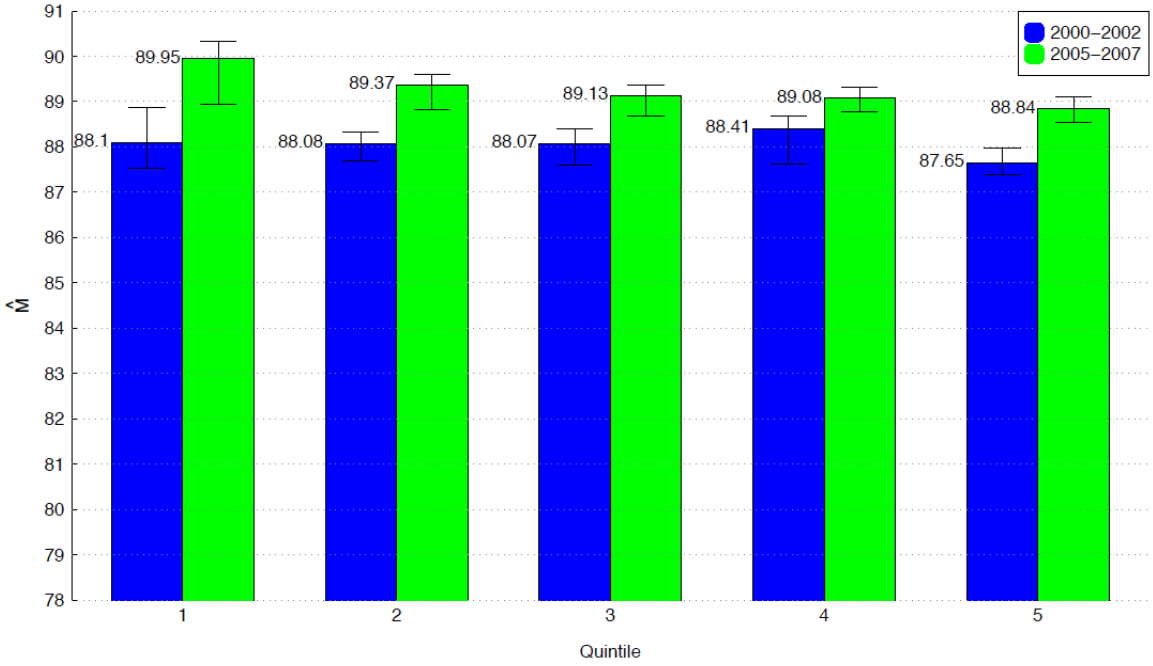

Figure 2: Smoothed density function by deprivation quintile (material and social combined), females, Quebec, 2000-2002 (solid line) and 2005-2007 (dashed line)

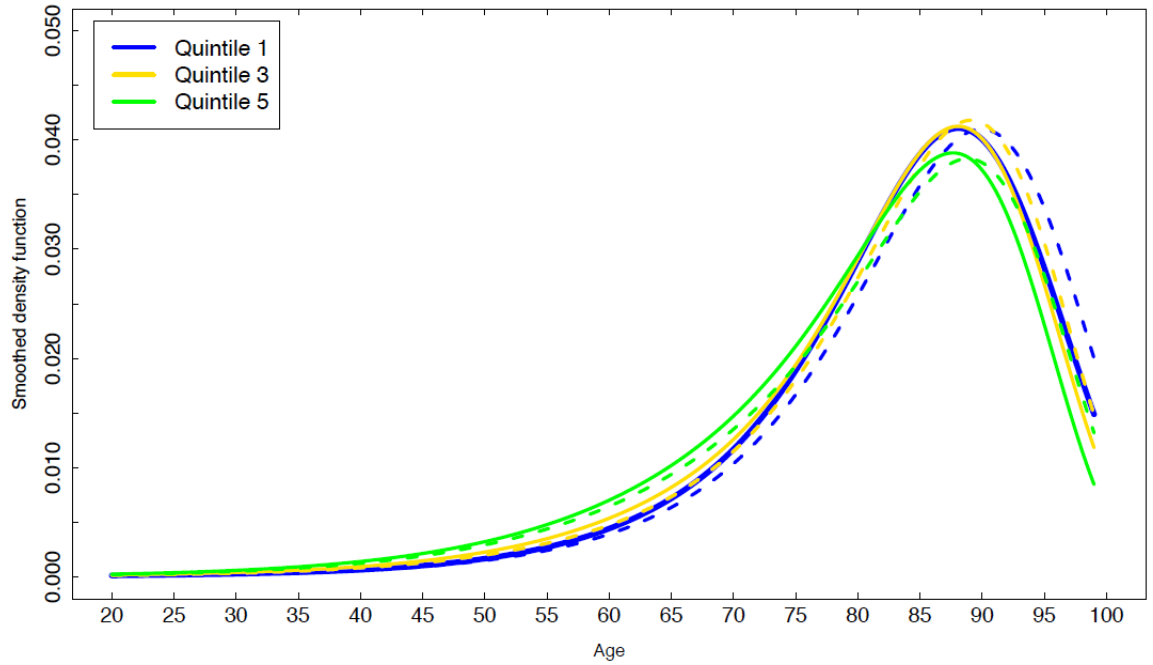

Figure 3: Modal age at death and 95% confidence intervals by deprivation quintile (material and social combined), males, Quebec, 2000-2002 and 2005-2007

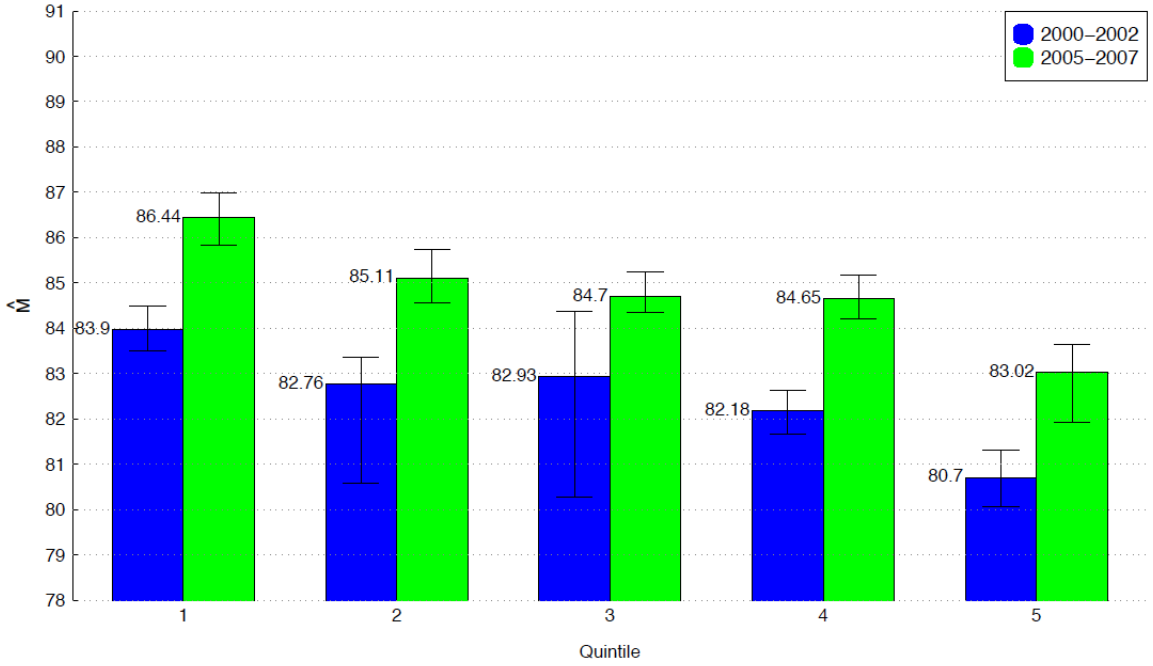

Figure 4: Smoothed density function by deprivation quintile (material and social combined), males, Quebec, 2000-2002 (solid line) and 2005-2007 (dashed line)

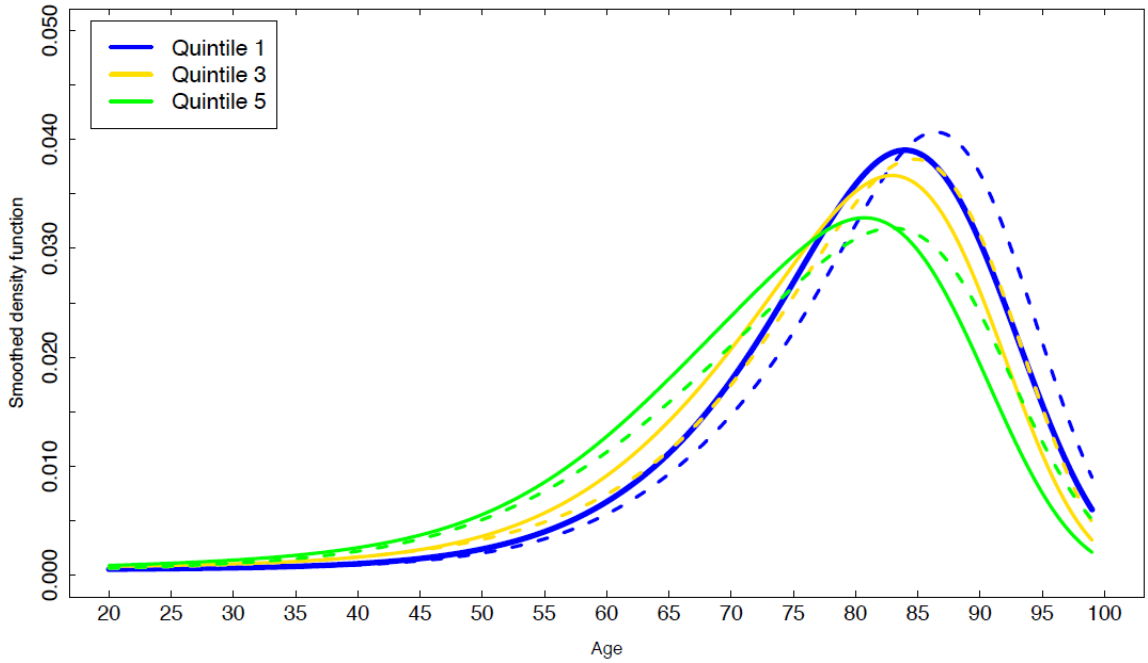

Table 1: Estimated standard deviation of ages at death above the mode and 95% confidence intervals by sex and deprivation quintile (material and social combined), Quebec, 2000-2002 and 2005-2007

		Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Female						
2000-2002	$\widehat{SD(M+)}$	6,96	6,44	6,42	6,44	6,14
		(6,50 - 7,28)	(6,26 - 6,63)	(6,18 - 6,66)	(6,23 - 6,79)	(5,92 - 6,32)
2005-2007	$\widehat{SD(M+)}$	6,57	6,13	6,28	6,00	6,36
		(6,34 - 7,12)	(5,92 - 6,39)	(6,10 - 6,51)	(5,81 - 6,16)	(6,16 - 6,54)
Male						
2000-2002	$\widehat{SD(M+)}$	7,51	7,78	7,24	7,53	7,87
		(7,08 - 7,81)	(7,30 - 8,72)	(6,41 - 8,48)	(7,17 - 7,81)	(7,50 - 8,22)
2005-2007	$\widehat{SD(M+)}$	6,89	6,70	6,89	6,75	8,08
		(6,39 - 7,27)	(6,22 - 7,01)	(6,56 - 7,10)	(6,37 - 7,02)	(7,71 - 8,66)

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