Was a long and healthy life always the privilege of the elite? The pre-industrial Québec case

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Abstract

Using the *Registre de la population du Québec ancien*, we examine mortality trends by socio-professional statuses after age 50 for men born between 1650 and 1750 in the Saint-Lawrence Valley. Survival models controlling for observed and unobserved factors show no significant effect for status, defined with a binary variable coded 1 for the elite (nobles, landlords, bourgeois, civil and military officers) and 0 for all others (including mostly farmers, but also artisans, small merchants, etc.). The use of a Heckman model accounting for sample selection bias due to mortality prior age 50 does not alter this conclusion.

Keywords: Historical Demography, Longevity, Social cause of death

Résumé

Au moyen du *Registre de la population du Québec ancien*, nous examinons la mortalité selon le statut socioprofessionnel après 50 ans chez des hommes nés dans la Vallée du Saint-Laurent entre 1650 et 1750. Un modèle d'analyse de durées ajustant les résultats en fonction de variables observées ou non nous révèle que ce statut, définit par une variable binaire codée 1 pour l'élite (nobles, seigneurs, bourgeois, officiers civils et militaires) et zéro pour tous les autres (incluant surtout des fermiers, mais aussi des artisans, des petits marchands, etc.), n'a pas d'effet significatif sur la longévité. L'utilisation du modèle d'Heckman corrigeant l'éventuel biais de sélection entraîné par la mortalité avant 50 ans ne modifie pas cette conclusion.

Mots clés : Démographie historique, Longévité, Causes sociales du décès

Introduction

The story has it that when she moved from New-France to her family estate near Rochefort in France, Madame Marie-Isabelle Bégon, widow of the Governor of Trois-Rivières, querulously asked "Where are those good partridges we left for the servants? I would gladly eat them now[1]." Madame Bégon's reminiscence exemplifies the prosperity of 18th century New-France, a society benefiting from nearly a half-century of relative peace (Frégault 1990) and growing at a pace rarely matched in human populations. The British navy eventually took control of France's possessions in North America, winning a decisive battle on the Plains of Abraham near Quebec City in 1759. But the regime change did not profoundly alter the basic demographic features of the rapidly expanding French Canadian population. Several visitors witnessed the prosperity of the Saint-Lawrence Valley and the contrast with contemporary Europe. Peter Kalm, a Swedish professor of natural history who visited the colony in 1749, was impressed by the hardiness of the Canadian *Habitants* (literally "inhabitants", or "settlers"). This contrasted with the contemporary peasant in France who spent his life sweating for a pittance and who often gave appearance of near starvation to prevent the tax collectors from taking away his meagre savings. Quite the contrary, the Canadian farmer could find land for most of his sons and often spare them the necessity of clearing the forest on a new seigniorial domain. In 1750, Kalm wrote:

> On entering one of the peasant's houses, no matter where, and on beginning to talk with the men or women, one is quite amazed at the good breeding and courteous answers which are received, no matter what the question is… Frenchmen who were born in Paris said themselves that one never finds in France among country people the courtesy and good breeding which one observes everywhere in this land (Kalm and Benson 1966).

[1] **Bégon, Élisabeth**, *Lettres au cher fils. Correspondance d'Élisabeth Bégon avec son gendre (1748-1753)*, Montréal, Boréal, coll. «Compact classique», 59, 1994, Notes and foreword by Nicole Deschamps, translated and cited in Eccles (1983).

Upon arrival in the colony more ten years earlier (1737), a Sulpician priest was much less wholehearted. He deplored instead the dissolute ways of the Canadiens, their independent manners, their stubborn insistence on being led and not driven, all of which that also annoyed military and civil officials. He remarked that officers, merchants, artisans, and habitants alike were "as poor as artists and as vain as peacocks" as they often spent what they have earned with much ostentation (Eccles 1983). He was genuinely appalled by these country girls who were "bedecked in lace and hoop skirt on Sundays, wearing their hair in a very elaborate, high-piled style" (ibid.).

There is little doubt that in comparison with contemporary Europe, there was much less social differentiation in the young North American colony. How could it have been otherwise? Settled along the Saint-Lawrence Valley and its principal tributary shores, the vast majority of the inhabitants were farmers who had open access to most subsistence resources. In particular, they could hunt and fish without limit – something unheard of in the home country – and there were plenty of opportunities for those who would be tempted by the fur trade and the adventurous voyages in the "*pays d'en haut*". Rather than strict allegiance to feudal lords, familial support and motivation to clear the forest were the key factors in the access to farmland and accumulation of material resources (Bouchard and de Pourbaix 1987; Bouchard 1996). Distinctions between social classes were less apparent and they did not translate into palpable differences in access to means of subsistence.

Yet, this idyllic portrait resembles other utopias – quite popular during centuries defined by Thomas More and Jean-Jacques Rousseau – and is certainly an exaggeration. After all, New France was a colony regimented under the paternalistic authority of an elite group of highly ranked civil, military, and ecclesiastic administrators who were nominated, sent and imposed from a distant and intransigent *Métropole*. Lands were granted to the Church and to a caste of "Seigneurs" (landlords), most of them from the nobility. The Seigneurs had special privileges and they could, in the case that the peasant did not pay his rent, appeal to a court provided by the King – a court that was able to enforce its decrees when necessary. As stressed by Greer (1985), even though some upper-class contemporaries and later historians have declared the Canadian habitant "the most independent man in the world" (as the historians L. Groulx and W.J. Eccles), others have insisted instead on his pledge to

Church, State, and aristocracy (Parkman, Ouellet, and Trudel). The English conquest of 1760 did not profoundly modify the rules of the Old Regime, at least not immediately (Trudel 2001), and the feudal tenure was maintained until the middle of the 19th century. Many of the Canadian elite who were born in France, however, returned to France, and a number of "seigneuries" (estates) passed into British hands through confiscation and bargain purchases from departing seigneurs (Matthews, Harris et al. 1987).

According to the theory of the fundamental causes of diseases, proposed by Link and Phelan (1995), social differentiation always lead to inequalities in access to knowledge, money, power, prestige and beneficial social connections, and these resources would always be used to the advantage of the superior classes to avoid disease and death. They argued that "people who command more of these resources are able to gain a health advantage – that is, to benefit from the fruits of human agency for public health to a greater extent than people who are less well endowed with respect to these resources" (Link and Phelan 2002). The contemporary examples are well known: access to the best doctors, knowing about beneficial health procedures, having friends and family who support healthy lifestyles, eating fruits and vegetables, exercising regularly, etc. Although Link and Phelan's empirical evidence does not reach back to periods prior to the industrial revolution, they seem to imply that their thesis would be valid any time and anywhere throughout the ages, hence the qualifier "fundamental" to describe the social causes of death. They wrote: "the reason social conditions are always prominent and always important is that resources shape access to health-relevant circumstances, whatever the list of such resources happens to contain in a given time or place" (Link and Phelan 2002). In other words: "Resources like knowledge, money power, prestige, and social connectedness are transportable from one situation to another, and as health-related situations change, those who command the most resources are best able to avoid risks, diseases, and the consequences of disease. No matter what the current profile of diseases and known risks happens to be, those who are best positioned with regard to important social and economic resources will be less afflicted by diseases." (Link and Phelan, 1995, p. 87). The elite groups of the 19th century, for example, would have been able to avoid the worst

sanitation housing and industrial conditions just as the higher social classes benefit now from healthy lifestyle circumstances.

But what about earlier periods in history? What about the pre-industrial era? Despite its apparently unobtrusive character – at least with regards to means of subsistence and appropriation of resources – was social differentiation in Old Quebec important enough to create distinctions in health and mortality between social classes? Following Link and Phelan, we may infer that the "way of life" of the Canadian elite – its lifestyle characteristics and behaviours, as a contemporary would put it – diverged substantially from that of the common people and that this divergence could be associated with significant mortality differentials. In other words, such assets as prestige, education, knowledge, and beneficial social connections could have conferred a better health to the pre-industrial Canadian elite, at least in comparison with their lower class counterparts (farmers, artisans, small merchants, etc.). Although there may be substantial differences among members of the same class, some studies have shown that position in the hierarchy itself could influence health and mortality through various means (Marmot and Wilkinson 2006)..

This paper seeks to assess whether or not there were mortality differences by social position among the elderly men (after age 50) of pre-industrial Quebec. More precisely, we followed cohorts of individuals born between 1650 and 1750, for which mortality was traced until complete cohort extinction from 1700 to 1850. We use family reconstitution data compiled from the parish registers by the *Programme de recherche en démographie historique* at the Université de Montréal (Desjardins 1998) and run several survival models controlling for observed as well as unobserved factors. Since selection of robust individuals at entry in observation at age 50 may correlate with any of the covariates included in our models – and in particular social status – we use the Heckman's (1979) sample selection procedure to account for possible bias caused by mortality selection.

Because of historical circumstances that will be explained below, the availability of information on occupations is relatively scarce for Old Quebec. Nevertheless, the scarce information allowed us to identify the members of the socio-professional elite in most instances, which were compared with the rest of the population living in the countryside (mostly farmers) and to the lower

socio-professional categories (such as artisans, small merchants, or innkeepers) in the towns of Montréal, Quebec City, and Trois-Rivières. The *Registre de Population du Québec ancien* provides a unique opportunity to test the Link and Phelan hypothesis of a fundamental social cause of death prior the industrial revolution. Data on mortality after age 50 to the middle of the 19th century also provide a good occasion to explore a relatively unknown period of North American demography, as there are virtually no accounts of mortality trends for the continent in this time period (Alter 1997).

Material and methods

Data and Population

We use family reconstitution data compiled from the parish registers by the *Programme de recherche en démographie historique* at the Université de Montréal. The database, the Registre de population du Québec ancien, comprises comprehensive data on the vital rates for the first centuries of the settlement of the French Canadian population (Desjardins 1998). Individual and familial biographies were reconstituted by linking individuals to their baptismal, marriage and burial certificates. The family, as well as the kinship networks in ascending, descending or horizontal lines can be traced in most cases, thus providing the researcher's with a unique access to rare demographic information. As the PRDH has recently added the burials of the first half of the 19th century, old age mortality patterns may be observed up to 1850 for people born in the colony prior to 1750. Overall, the database contains 803,900 certificates from 153 parishes (PRDH 2008). From the outset, priests were entitled by Rome to record baptisms, marriages, and burials. Parishes were organized rapidly and when demographers began microfilming the registers in the late 1960s, they generally found them in very good condition. As the database covers the whole territory, very few individuals who settled down in the colony escaped the observation of the demographers because of "lost to follow-up (Desjardins 1995). Those missing are due to returns to France not yet identified as such, random loss of registers and insufficient or faulty identification of the deceased, factors who do not pose any bias problems.

During the French Regime (1608 to 1759), Canada developed from a small colonial fur trading post to a colony with a sizable administrative and military organization. Although the winter was long and hard, the abundant rain and the warm summer allowed for the growth of dense forest vegetation and a diversified fauna, rich with game and fish. Population growth was nevertheless initially slow, with only a thousand individuals in 1650. Since it was the natives who collected and transported the furs – and not the colonists – there was initially little motivation to favour the development of a large labour force. A series of native wars that shattered the supply and incidentally terrorized the inhabitants forced the French to take care of the trade themselves, creating the incentive for colonial development and demographic expansion. In 1663, the French Crown decided to send settlers ("*engagés*") through various means, along with military contingents to protect the colony and its assets.

This relatively intensive peopling effort from the Crown was to be short in duration. Ten years later, fearing depopulation in the home country, the Métropole suddenly dismantled the policies favouring emigrations toward the colonies. Thereafter New France had to rely on its own natural increase to ensure its demographic future (Charbonneau 1975). Yet, by the early 18th century, an agricultural population of approximately 20,000 inhabitants had settled along the Saint-Lawrence River. Quebec City and Montreal, the main ports of entry in Nouvelle-France, were emerging as urban centres with important administrative and economic roles. The banks of the river were occupied from a few kilometres above Montreal to downriver below Quebec City, on both sides of the Saint-Lawrence. Almost all of these people were farmers settled on their own long-lots farms of some 60 – 120 *arpents* (an arpent is 1/3 of a hectare). By the turn of the 19th century, there were approximately 200,000 inhabitants in the colony that became to be known as the "Province de Québec" (Charbonneau, Desjardins et al. 2000).

Emigrants from France had left an old densely populated rural country to come to a New World Valley with abundant land. Labour was scarce and expensive, local markets were either inexistent or minute, and external markets very far away. Only fish and furs could be exported profitably – not always, though, as some learned the hard way in the last years of the 17th century,

when the price of the furs suddenly fell (Dechêne 1974). In this context, as explained in the introduction, there were very few opportunities for rigid socioeconomic stratification to emerge. Moreover, largely accessible lands in the countryside provided an exit for the poor. Still, although great landed or commercial fortunes had yet to emerge in the recently settled colony, there are numerous accounts of the formation of a rural proletariat in many parts of the colony at the turn of the 19th century. Many regions witnessed the appearance of a landless class of inhabitants who had to sell their workforce to pay their rent or numerous charges (Ouellet and Hamelin 1962; Greer 1985; Dessureault 1987). There is considerable debate as to what are the ultimate causes of the changes that took place during this period – demographic saturation, penetration of capitalism, outdated agricultural practices, etc. (see Dessureault 1987 for a review) but it is clear that by the early 1900, it was no longer possible for the majority of young men to acquire lands in their home parish (Greer 1985). Because we selected individuals who were all born before 1750 – and who were thus more than 50 years old in 1900 – these changes are of a moderate concern for the sake of the present analysis. Further, as explained below, we are not concerned so much with the differences among the lower classes but only with distinction between the elite and the rest of the population.

The definition of social position

Although the pre-industrial parish registers are suitable for family reconstitution, these precious documents are relatively incapable of elucidating details about socioeconomic statuses[2]. Most of the times, the Priests, whether officiating a marriage, a baptism or a burial, would not write down the occupation of his parishioners. Why bother? Most Canadians were simple farmers, or *habitants*. However, there are notable exceptions to what would appear as a general neglect to current standards and these recurrent exceptions exemplify the social hierarchy that was well and truly present in the colony: the priest systematically emphasized the social ascendancy of a parishioner from a higher social class in the register. Social rank was everything in those days and if a priest was to forget it, any

[2] Other documents contain mentions for the occupation, but these are rare and not immediately accessible. Only three nominative censuses were taken over the entire colony in the 17th century (in 1665, 1666, and 1681), and none before the end of the French regime, with the exception of those undertook in Quebec City in 1716 and 1744. All these censuses are included in the RPQA but overall the coverage remains sparse.

highly ranked civil servant, *Seigneur*, or militia captain would certainly insist that his occupation or his *marque de noblesse* – if he had any – be written down, along his name. Declarations of occupations outside of agriculture also appeared in the registers, but to a much lesser extent[3].

We used three forms of declaration providing an indication of the "socio-professional" status in the parish registers: *occupation* (farmer, baker, soldier, etc.); *quality* (squire, bourgeois, etc.); and *honorific charges* (churchwarden, syndic, etc.). From this, a code containing 260 classes was established (Charbonneau, Larose et al. 1980). This code will serve as our basis to identify the elite, including all the individuals having a highly ranked occupation, a honorific charge, or a *marque de noblesse* (all the corresponding declarations are listed in the annex). The Common group consists of all the other individuals, including farmers, artisans, etc. We did so for the individuals in focus, i.e., ego, but also for their fathers, thus allowing for a distinction between effects from early life and adult life.

The assessment of a socioeconomic status and the measurement of its effect on health is by itself a difficult exercise and the study of the relationship between this status and adult mortality adds an extra layer of difficulty. As an example, suppose that markers of high socioeconomic statuses are systematically given relatively late in life, as we can reasonably expect to be the case in a meritocracy in which nepotism is kept to a minimum (the "American dream" so to say). Meritorious individuals, after a long life of precious service to their country, are rewarded with a price for their life-time achievement. If such process was the only one through which high rank marks were "issued", we would (wrongly) find a very strong beneficial effect of having a noble title on survival to old ages. Because the origin of time in our analyses is age 50, any mention that would be taken for an individual who is more than 50 years of age could amount to an instance of reverse causality in which survival would be a condition for the attainment of the age at which the mention is discerned. We would also underestimate the mortality of these individuals by implicitly supposing that the risk of death is null

[3] One good indication of this bias in reporting the occupation by social position is the frequency with which a prestigious occupation is mentioned in the registers (at the baptisms of the children) after its first appearance (at a marriage).

before the age at which the title is issued[4]. In this context, gathering declarations of occupation at face value, without regards to the age at which the declaration is made can lead to seriously biased results.

Unfortunately, there is no satisfying solution to this problem. Individuals from the elite generally had a mention of their status at a relatively earlier age than age 50, and we were thus able to assign an "elite" status to the majority of them (i.e., all those who are associated with such a declaration before the age of 50). However, many had a first declaration of socio-professional status after the age of 50 and whether or not these individuals are included in the analyses has an impact on the results. We have supposed above that any member of the elite would necessarily be able to ensure that his/her status would be written down in the parish register. However, we could also argue that if an individual did not "secure" an elite status early in life, then we may suppose that the individual in question was not, after all, a prominent member of the elite. Being fully aware that we will need to address this issue with more advanced methods, our partial solution for now was to assign the status only if the father was also from the elite.

Environmental and familial control variables

Previous enquiries on the pre-industrial population of Quebec have highlighted the roles of familial as well as temporal and environmental factors in the determination of mortality levels in late adulthood (Charbonneau and Desjardins 1990; Blackburn, Bourbeau et al. 2004; Mazan and Gagnon 2007; Gagnon, Mazan et al. 2008; Gagnon and Mazan 2009). Birth cohorts, defined on a ten year basis, were used here to capture temporal variations. Overall, life expectancy at age 50 is at a minimum in the cohorts born around 1700 and increases to a maximum in the cohorts born around 1720-30 (not shown here). Since mortality was much higher in the City than in the countryside, we introduced an urban/rural control in four categories: born and lived in a rural area (reference category);

[4] In the case of Old Quebec, the opposite bias could also occur if we were to consider only the individuals who have a mention of a profession. Prior 1795, there was no obligation for the priest to report the occupation of his flocks. Only the higher or unusual statuses or occupations would be declared. After 1795, however, the priests were entitled to write down the occupation of every parishioner. As a result, a laborer born around 1710, who would have been the subject of numerous parish certificates throughout his life without any mention of his occupation could finally find this mention beside his name, but posthumously, in his death certificate, say in 1796. This could create a negative association between mortality and socio-professional position; among the laborers born around 1710, only those who would have survived to age 85 would receive the mention "laborer".

born and lived in an urban area; born in a rural/lived in an urban area; and born in an urban/lived in a rural area. Urban/rural residence in adulthood was defined as the place of birth of the last child. The distinction of rural versus urban resident is critical, and particularly in the present case since the nobility and the bourgeoisie generally lived in the cities and mortality was higher in urban areas than in the countryside (because of a higher prevalence and severity of epidemics; Mazan, Gagnon, and Desjardins, *forthcoming*). Mortality also varied between the Eastern and the Western part of the colony, justifying a "region of residence" predictor as another "environmental" control.

To account for familial variations in the risk of death, we introduced the ages at death of the parents and of the spouses in our models. These familial control variables proved to be among the strongest predictors of old age mortality in previous studies (Mazan and Gagnon 2007; Gagnon and Mazan 2009). Using these control variables nevertheless imposes stringent selection criteria since the information must be complete for each individual selected on all the variables (information on parents, spouses, etc. must be available). The main conclusions concerning our main variable of interest, however, was not changed when the restricting criteria were removed (not shown here). We also tested other variables such as birth order and number of siblings, which proved significant in a recent study of social mobility of the 19th-20th centuries Saguenay-Lac-Saint-Jean of Quebec (Tremblay and Vézina 2008). In the present study, these variables had a marginal effect (number of sibling) or no effect at all (birth order) on old age mortality and are thus not included. Overall, our sample consists of 11,641 men born between 1650 and 1750, who survived at least to age 50, and who had a value for all of the control variables.

Multivariate models

The natural entry for the study of adult mortality is through the use of survival models. We ran proportional hazard models assuming an exponentially increasing risk of death (Gompertz) from age 50 to the complete extinction of the cohorts. These models include the variables of interests, i.e., whether or not the individual or the individual's father is from the elite, as well as the series of control variables listed above. Even though a fair amount of control variables were considered, it would be

presumptuous to argue that, together, these controls account for all of the variation in mortality. Since individuals are clustered within families, we used a random effect accounting for interfamilial variation in the risks of deaths (Cleves, Gould et al. 2004) (frailty). Following model estimation assuming a gamma distribution of frailty (Vaupel, Manton et al. 1979), the variance of the random effect is obtained, usually referred to as "theta" and reflecting the interfamilial variation in the hazard. Taking the square root of this factor and exponentiating the result gives the typical or the average variation in mortality between families in a convenient hazard ratio metric (Pankratz, Andrade et al. 2005). Defined for each familial cluster, such theta will account for a latent common group effect shared by family members.

Unobserved heterogeneity in the observed cohort generally leads to downward biases in parameter estimates and p-values (Garibotti, Smith et al. 2006). Mortality selection before the observation period is another source of hidden heterogeneity. In the present case, it is easy to realise that variables that affect survival after age 50 could also affect the probability of even surviving to that age. For example, would the probability of surviving to age fifty vary by social position? If so, and if survival after age 50 also varies by social position, then our parameter estimates could be biased. As a first solution to this potential problem, we performed the Heckman sample selection procedure (Heckman 1979), a very popular technique among economists that is available in Stata 9. The idea is to simultaneously model two equations: one equation for the outcome of interest (i.e., survival after age 50), another for the selection process (i.e., survival to age 50), and to assess the relationship between the errors of the two models. If the association between the errors of the two models is significant, then the process underlying the selection also affects the outcome of interest and a method not accounting for this lack of independence will produce biased estimates in the outcome equation. Heckman's procedures account for this correlation and "revise" the parameter estimates of interest. It is important to note that these procedures are quite sensitive to the choice of the covariate entering the selection equation (Winship and Mare 1992; Stolzenberg and Relles 1997), and so proper model specification for this equation is just as important as it is for the outcome equation. Here we are modelling selection (survival) from age 0 to 50, which means that variables measured for an individual

within this interval cannot be considered. It would not be appropriate, for instance, to include the region of residence at the adult life stage or the social position in the selection model because there are no such measurements for an individual who died in infancy. See table 2, panel b for the choice of the variables entering the selection model.

Given the nature of the outcome variable, it would be preferable to use a method suitable for *time to event data* that accounts for sample selection (Prieger 2002; Boehmke, Morey et al. 2006). Results from these methods, however, are not immediately estimable using standard statistical software. At any rate, since individuals are observed to complete extinction, right censoring is not an issue and modelling age at death as a continuous variable should be satisfactory. Further, the distribution in age at death after age 50 is roughly normal and the large sample size should lead to estimates that are asymptotically correct.

Results

Figure 1 presents the proportion alive after age 50 up to complete extinction of the cohorts. Two curves are presented. The first represents the "common people", while the second represents the elite. The curves are almost undistinguishable, so it seems at a first glance that there were no differences in mortality after age 50 between the two groups. However, there are no controls for coincidental associations that could affect the results in this figure; we thus revert to a multivariate model.

FIGURE 1 ABOUT HERE

Table 1 presents the results of a parametric Gompertz survival model. Entries for each variable are hazard ratios, which can be interpreted as mortality rate ratios. The entries for the birth cohorts shows that men born between 1720 and 1729 had hazard rates that was 16.9% (i.e., 1 – .831) lower than in the 1650-79 cohort (the reference category). Overall, mortality is higher for the cohorts born before 1720 or after 1729. As expected, living or not living in an urban area was also critical to an individual's chances for survival in old ages. In comparison with their rural counterparts, those who lived in the city had higher mortality rates, whether or not they were born in the city. The hazard

increases by approximately 15 – 23% for city dwellers. The region of residence also influences mortality but to a lesser extent. There is also an inversion of the effect when comparing place of birth to place of residence. The variables pertaining to the survival of family members also have a quite sizeable effect, especially for the age at death of the spouse, which, for each additional year, gives approximately 0.7% reduction in the mortality rate (or 1 – .993 = .007). Ten more years in the age at death of a spouse would represent a reduction of 7%. On the other hand, being from the elite, whether by birth or during adulthood does not seem to bear a significant effect on survival chances after age 50, confirming the result from our previous graphical enquiry (Figure 1): the two parameters estimates are not significant and the one for the father's status does not run in the expected direction.

TABLE 1 ABOUT HERE

The theta parameter, which appears in the bottom of the table, represents the variance of frailty (supposing a gamma distribution). As seen from the likelihood ratio test, the parameter is highly significant. The magnitude of the per-family variance component is .07. The corresponding standard deviation (.265) implies that the average spread of relative risk among families is $1-\exp(.265)=30\%$ (see Pankratz, Andrade et al. 2005). The per-family risk of death is on average about 30% larger or smaller than the overall risk of death, reflecting a sizeable degree of familial aggregation of risks death unaccounted for by the listed predictors. Supposing an inverse Gaussian, instead of gamma, distribution of frailty produces similar results.

Although the previous model makes provision for unobserved factors among individuals entering in observation at age 50, it can still leave aside other possible sources of variation. As explained above, one process that can affect the distribution of frailty is *sample selection bias* whereby the sample is biased toward the more robust individuals because those who had a higher risk of mortality did not even make it to the age at which observation begins. People from lower social status may suffer from a high mortality before age 50. If so, survivors from this social group may represent a select group of robust individuals. As a result, the eventual disadvantage associated with their condition could be hidden. Table 2 provides an attempt to model the impact of sample selection bias. The results for *a) the outcome equation* (i.e., estimates of the predictors' effect on ages at death, in

years) appear in the upper panel of Table 2, while the results for *b) the selection equation* (i.e., probit estimates assessing the chances of being in the sample) are in the lower panel of the same table. Table 2 also presents the correlation between the residuals of the two equations (i.e., "rho").

TABLE 2 ABOUT HERE

We consider the second panel first, for which all the predictors prove highly significant. Note however that this panel has a much larger sample size than the upper one; indeed, all individuals for which we had a recorded birth and a value for all the covariates listed in the model are included in the selection equation, whether they survived up to age 50 or not. The parameter estimate for individuals born in c.1680-89 is –.285, meaning that in comparison with the reference cohort (c.1650-79), the odds of being selected (i.e., being part of the sample who survived to age 50) are reduced by approximately $1-\exp(-.285\times 1.7)=38\%$, a relatively high figure[5]. Birth cohort effects are indeed quite large and mostly explained by variations in infant and child mortality throughout the whole period of observation (Gagnon and Mazan 2009). Comparable was the detrimental effect of a birth in the city, where infant mortality was the highest. Other noticeable effects include the father and the mother's ages at death, both being significant and important. Contrarily to expectations, a higher social status for the father appears detrimental for the selection into the group of survivors after age 50. This apparently odd result is explained by the prevalence of wet-nursing among the higher social classes, a practice increasing infant mortality that was virtually absent among the peasants. Wet-nursing was widespread in pre-industrial Europe, particularly in France (Bardet 1983), and was studied in details for the town of Quebec City (Gauvreau 1986; Gauvreau 1987). The emigration back to France of the nobility after the 1759 Conquest is not a likely factor because it mostly concerned the highly ranked civil and military officers (Trudel 2001) and did not really affect the Canadian born elite.

The next parameter to consider is "Rho", the correlation between the errors of the two processes. If this correlation was small and not significant, there would be no need to worry about

[5] The interpretation of a probit coefficient *b* is that a one-unit increase in the parameter leads to increasing the probability of selection score by *b* standard deviations. By way of comparison, logits tend to be about 1.7 times larger than probits.

sample selection: a number of factors may explain why some individuals are included in the analyses (survived to age 50) and why others are not, but this will have no effect the outcome of interest, i.e., mortality after age 50, if the errors are independent. In the present case, however, the correlation is not null (0.123) and significant (p=0.0057), which means that the selection process affects in some ways the outcome. The sign of the correlation is also indicative of the unobserved factors' influence. A positive correlation means that any component of the (unmeasured) errors that make the selection more likely also makes the dependent variable in the outcome higher. A tentative interpretation here is that the correlation Rho is the equivalent of a frailty parameter measured at the individual level: what's unmeasured but make individuals more likely to survive to age 50 (to be selected) is a hidden health factor that would also make individual more likely to survive longer after that age.

We can now examine the results in the upper panel. We focus here on the variable of interest, social status, which is now significant. We should not, however, make a strong case of this result, as the sample size is quite large. Grossly speaking, the parameter estimates in the outcome equation may be seen as a coefficient from an ordinary least square regression. In the present case, being from the elite would mean .8 years extra years, which is relatively small. Additionally, when varying the criteria for the definition of the elite in some models, the significance sometimes disappeared (not shown here). Finally, accounting for the negative influence of having a father from the elite in the selection model (survival to age 50) makes the coefficient slightly smaller for the effect of ego's own social status in the outcome model (survival after the age of 50). Thus, accounting for sample selection bias does not fundamentally alter the previous result that the elite status does not confer a survival advantage in pre-industrial Quebec.

Discussion

This brief incursion into the pre-industrial patterns of mortality in the Québec population did not yield the expected results in two respects. First, being from the elite was not found to be beneficial to survival in old ages. The parameter for the individual's social status was not significant while the parameter for the father's status ran in the opposite direction (although not significant either). Second,

when using the Heckman sample selection procedure, we did not find that a higher social status in the family of origin (as traced by the father's social position) would lead to higher chances of survival to age 50, which could have accounted for the absence of a genuine effect in our enquiry. Indeed, just the opposite was found: individuals whose father was from the elite were less likely to survive to age 50, probably because of higher infant and child mortality levels in these families.

Thus, apparently, there was no consistent or coherent effect of social position on longevity in pre-industrial Quebec. Despite our numerous efforts to construct a sound categorisation of the socio-professional reality of the time, we are aware of the drawbacks of a binary classification. What were the differences between artisans and farmers, for instance? Of this, we have no indication. It could well be that the fresh air of the countryside benefited farmers over artisans, who usually lived in the city, albeit a model simultaneously controlling for residential and social statuses could yield unexpected results in this regard. What about the differences between merchants and artisans living in urban areas, for instance? Some occupations also incurred significantly higher mortality risks, such as tanners, who were exposed to various health hazards (Christian Dessureault, *personal communication*). At a minimum, three or four categories of socio-professional statuses would be needed. And this could still be insufficient as classifications based on socio-professional statuses (here recorded in parish registers) are blind to variations in wealth among members of the *same* socio-professional group. Using estate inventories of the 18th and 19th century Yamaska region, Dessureault (1987) revealed notable economic differences within the peasantry itself. Hardy (1987) also reported striking inequalities in wealth contrasting prosperous and less prosperous artisans of Quebec City and Montreal. It would be interesting to examine how the appearance of a class of landless peasants selling their workforce on large estates during the first half of the 19th century (Ouellet and Hamelin 1962) may have favoured and conditioned the emergence of genuine social differences in mortality. A forthcoming study (Bohnert and Gagnon, 2010) has also established that the size of the estate on which a man was brought up in the countryside at the turn of the 20th century was significantly related to survival after the age of 40. Given the data at hand for the present study, however, decomposition in two categories was the only feasible alternative.

Despite the previous drawbacks, we are confident that further specification of the socio-professional categories would not fundamentally alter one main conclusion of this paper: higher social position did not always mean better chances of survival to old ages such as predicted by the "fundamental social causes" theory, proposed by Link and Phelan (1995). The brief historical sketch of the introduction provides a reasonable explanation for the historical Quebec case: although New France was one society where there was "no land without a landlord", economic differences among its inhabitants were relatively small, and this made social hierarchy less consequential to the appropriation of the essential resources for their survival. After all, early Canadian estates were of little value, and the Crown regularly had to intervene in favour of the nobility in order to help maintaining a semblance of aristocratic life (Dechêne 1971; Dechêne 1974).

Be that as it may, it is safe to assume that even if marked, social hierarchy in the past was generally just as loosely related to health and longevity as in the present case. Before the 20th century, the causes of mortality were poorly known and it is unlikely that those occupying the top of the hierarchy were able to positively influence their health in any systematic way. In fact, wealth had it own hazards as well demonstrated for England (Razzell and Spence 2006). At the time, only the rich could afford tobacco and all these leisure that came to be seen nowadays as "risks factors for health."

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Annex

Denominations used to assign the “elite” social status (based on Charbonneau, Larose et al. 1980):

	Type of occupation or title	**English Translation**
	Titres ou fonctions honorifiques	*Honorific functions or titles*
0A	Baron	Baron
	Comte	Count
	Marquis	Marquis
	Chevalier	Knight
0B	Écuyer	Squire
	Homme noble	Noble man
0C	Seigneur	Landlord
0D	Bourgeois	Bourgeois
0E	Capitaine de Milice	Militia captain
0F	Officier de milice	Militia Officer
0G	Marguillier	==
	Syndic	Syndic
	Échevin	Municipal Councillor
	Construction	*Construction*
6A	Constructeur de navire	Shipyard
6B	Entrepreneur	Entrepreneur
6C	Contremaître	Foreman
	Transport, commerce	*Transport, Commerce*
7A	Négociant	Monger, Dealer
	Armateur	Ship-owner
	Assureur	Insurance agent
7B	Marchand Bourgeois	Merchant Bourgeois
7C	Marchand	Merchant
7D	Hommes d’affaires	Businessman
	Banquier	Banker
	Directeur	Director
7E	Commandant de bord	Commandant
	Capitaine de navire, de vaisseau, barque	Sea-Captain
	Lieutenant de navire	Lieutenant
	Navigateur	Navigator
	Marinier, Maître de barque	Bargee
	Pilote	Pilot
	Professionnels de la santé	*Health Professional*
8C	Médecin	Physician
	Chirurgien	Surgeon

Denominations used to assign the “elite” social status (cont…)

	Type of occupation or title	**English Translation**
Hommes de loi		*Lawmen*
8D	Juge	Judge
	Avocat	Lawyer
	Notaire royal ou seigneurial	Royal or Manorial Notary
	Procureur	Prosecutor
	Greffier	Clerk
	Praticien	Practitioner
Professions techniques		*Practical Occupations*
8E	Architecte	Architect
	Arpenteur	Surveyor
	Hydrographe	Hydrograph
	Ingénieur	Engineer
Enseignement		*Instruction*
8F	Enseignants	Teachers
Services publics (dirigeants, haut fonctionnaires)		*Public Services (leaders, public servants)*
9A	Gouverneur	Governor
	Intendant	Intendant
	Commissaire de la marine	Navy Commissioner
	Commissaire ordonnateur	Organizer Commissioner
	Subdélégué de l’intendant	Sub-delegate of the Intendant
	Conseiller au Conseil supérieur de Québec	Advisor to the Superior Council of Quebec
9B	Haut fonctionnaire	Highly ranked Public Servant
9C	Officier de justice	Officer of the Court
Gradés militaries		*Military Officers*
9F	État-major de la colonie	Military staff of the Colony
9G	Officiers	Officer
9O	Soldats gradés	Non commissioned Officer

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Table 1. Gompertz model of mortality after age 50 with shared frailty among brothers (Men born 1650–1750; N=11,641)

Variable	Hazard ratio	P-Value	[95% Confidence Interval]	
Birth cohort				
c.1650-79		Reference		
c.1680-89	1.019	0.782	0.893	1.162
c.1690-99	1.093	0. 132	0.973	1.228
c1700-09	0.969	0.579	0.867	1.083
c.1710-09	0.871	0.012	0.781	0.971
c.1720-29	0.831	0.001	0.748	0.924
c.1730-39	0.871	0.008	0.786	0.965
c.1740-49	0.901	0.053	0.811	1.001
Residence				
Born and lived in the Countryside		Reference		
Born and lived in City	1.155	0.001	1.063	1.255
Born in Countryside; lived in City	1.232	<0.001	1.132	1.341
Born in City; lived in Countryside	0.972	0.419	0.907	1.041
Lived in the West (Ref.= East)	1.124	0.017	0.873	0.987
Family				
Father's age at death	0.996	<0.001	0.995	0.998
Mother's age at death	0.997	<0.001	0.996	0.999
Spouse's age at death	0.993	<0.001	0.992	0.995
Social Position				
Elite	0.942	0.120	0.874	1.016
Father is from the elite	1.024	0.464	0.961	1.091
Gamma	0.091	<0.001	0.089	0.094
Theta	0.070	<0.001	0.051	0.096

Table 2. Heckman's model of age at death given selection prior age 50 (Men born 1650–1750)

a) Outcome Equation (N=11,641)

Variable	Estimate	P-Value	[95% Confidence Interval]	
Birth cohort				
c.1650-70		Reference		
c.1680-89	-0.598	0.355	-1.865	0.669
c.1690-99	-1.023	0.076	-2.154	0.108
c.1700-09	-0.327	0.565	-1.439	0.786
c.1710-09	0.891	0.106	-0.191	1.973
c.1720-29	1.353	0.012	0.302	2.405
c.1730-39	0.963	0.065	-0.060	1.986
c.1740-49	0.506	0.350	-0.554	1.566
Residence				
Born and lived in the Countryside		Reference		
Born and lived in City	-1.825	0.000	-2.670	-0.981
Born in Countryside; lived in City	-2.047	<0.001	2.824	-1.270
Born in City; lived in Countryside	-0.156	0.664	-0.858	0.546
Lived in the West (Ref.= East)	-1.163	<0.001	-1.735	-0.591
Family				
Father's age at death	0.031	<0.001	0.017	0.046
Mother's age at death	0.035	<0.001	0.023	0.048
Spouse's age at death	0.071	<0.001	0.058	0.085
Social Position				
Elite	0.803	0.025	0.102	1.503
Ego's father is from elite	-0.154	0.636	-0.792	0.484
Intercept	60.007	<0.001	57.961	62.052

Table 2. Heckman's model of age at death given selection prior age 50 (cont…)

b) Selection equation (N=28,397)

Variable	Estimate	P-Value	[95% Confidence Interval]	
Birth cohort				
c.1680-89	-0.285	<0.001	-0.398	-0.206
c.1690-99	-0.083	0.019	-0.213	-0.019
c1700-09	-0.190	<0.001	-0.339	-0.142
c.1710-09	-0.319	<0.001	-0.482	-0.283
c.1720-29	-0.281	<0.001	-0.440	-0.245
c.1730-39	-0.281	<0.001	-0.455	-0.260
c.1740-49	-0.445	<0.001	-0.674	-0.478
Residence				
Born in urban area (Ref.=rural)	-0.462	<0.001	-0.502	-0.419
Born in the West (Ref.=east)	-0.059	<0.001	-0.095	-0.029
Family				
Father's age at death	0.003	<0.001	0.005	0.007
Mother's age at death	0.006	<0.001	0.003	0.005
Social Position				
Ego's father is from the elite	-0.124	<0.001	-0.165	-0.064
Intercept	-0.376	<0.001	-0.498	-0.254
Rho	0.123	0.0057	0.036	0.209

Figure 1 Proportion alive among men from the Elite and the Common people after age 50