CONSTRUCTION OF EXPERIENCE LIFE-TABLES FOR THE ALGERIAN SURVIVOR PENSION BENEFICIARIES

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Received: 11/11/2021/ **Accepted**: 18/09/2022 / **Published**: 22/06/2023
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ABSTRACT

The objective of this paper is to construct periodic life tables based on the mortality experience of the Algerian survivor pension beneficiaries. Usually, the mortality of the retirees is lower than that of the global population, essentially due to better living conditions and access to health care. Also, we aim to verify if mortality is different between the categories of survivor pensioners and to adapt the actuarial life tables accordingly, which may result in actuarial valuations more adapted to the risk function of each subpopulation. To this end, we compare three parametric models i.e., the Gompertz model, the Kannisto model and the Heligman & Pollard model. Results show a significant difference between the life expectancy of the survivor pension beneficiaries and that of the direct retirees and between the categories of survivor pensioners.

KEY WORDS: Pensions, mortality, parametric models, fitting.

JEL CLASSIFICATION: J32, J11.

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بناء جداول حياة للمستفيدين من معاشات الباقين على قيد الحياة في الجزائر

ملخص

يهدف هذا المقال إلى وضع جداول حياة دورية على أساس تجربة وفيات المستفيدين من معاشات الباقين على قيد الحياة في الجزائر. تقل وفيات المتقاعدين بشكل عام عن وفيات السكان العام، ويرجع ذلك أساسًا إلى ظروف معيشية أفضل والحصول على الرعاية الصحية. نهدف أيضًا إلى التحقق مما إذا كانت الوفيات تختلف أيضًا بين فئات الباقين على قيد الحياة وتكييف جداول الحياة الاكتوارية وفقًا لذلك، مما قد ينتج عنه تقييمات اكتوارية أكثر تكيفًا مع معادلة الخطر لكل مجموعة فرعية.

نقارن ثلاثة نماذج علمية مثل نموذج Gompertz، نموذج Kannisto ونموذج Pollard&Heligman. تظهر النتائج فرقا كبيرا بين متوسط العمر المتوقع للمستفيدين من معاشات الباقين على قيد الحياة وتلك الخاصة بالسكان المتقاعدين، وحتى بين فئات المستفيدين من معاشات الباقين على قيد الحياة.

الكلمات المفتاحية: معاشات، وفيات، النماذج المعلمية، التعديل.

CONSTRUCTION DES TABLES DE MORTALITÉ D'EXPÉRIENCE POUR LES BÉNÉFICIAIRES D'UNE PENSION DE RÉVERSION EN ALGÉRIE

RÉSUMÉ

L'objectif de cet article est de construire des tables de mortalité périodiques basées sur la mortalité d'expérience des bénéficiaires d'une pension de réversion en Algérie. La mortalité des retraités est généralement inférieure à celle de la population globale, essentiellement en raison de meilleures conditions de vie et d'un meilleur accès aux soins de santé. Aussi, nous cherchons à vérifier si la mortalité est différente entre les catégories de pensionnés de réversion et adapter les tables de mortalité actuarielles en conséquence, ce qui pourrait aboutir à des évaluations actuarielles plus adaptées à la fonction de risque de chaque sous-population. A cette fin, nous comparons trois modèles paramétriques, à savoir le modèle de Gompertz, le modèle de Kannisto et le modèle de Heligman & Pollard. Les résultats montrent une différence significative entre l'espérance de vie des bénéficiaires d'une pension de réversion et celle des bénéficiaires d'une pension directe, et entre les catégories de pensionnés de réversion.

MOT-CLÉS : Pensions, mortalité, modèles paramétriques, ajustement.

INTRODUCTION

Assessing the financial sustainability and the actuarial fairness of a retirement system requires using adapted actuarial life tables, among other economic and demographic parameters. Lifetables measure the level of mortality of a population at different ages in a probabilistic manner (UNFPA, 2011).

The mortality of the retirees is generally lower compared to that of the global population, essentially due to better living conditions and access to health care (Flici & Planchet, 2019). Thus, using global population life tables, annually published by the Office of National

Statistics (ONS), for actuarial calculations is not appropriate, actuarial life tables must rely on the experience of the directly concerned population. Flici and Planchet (2019) constructed life tables for the Algerian retirees receiving direct pensions. They observed a high similarity for males but a significant difference for females. At age 50, the remaining life expectancy was much higher for the female retirees compared to the female global population. The authors concluded that, in 2014, the life expectancy at age 50 for the global male population was 0.27 years higher than that of the retired male population, which is supposed to fall to nearly zero by 2050. Whereas, at age 50, retired women are expected to survive 3.6 years longer than the women of the global population, a gap that is expected to fall to 2.2 years by 2050.

In Canada, the mortality difference between the global population and Canada Pension Plan (CPP) beneficiaries, and between the categories of CPP beneficiaries was studied by the Office of the Chief Actuary (OCA, 2015). In 2013, the CPP survivor pension beneficiaries' mortality, at age 65 years and older, was significantly higher than that of the global population by around 31% for males, and 34% for females. Also, it was higher than that of the direct retirement beneficiaries. At 65 years old, a survivor pension beneficiary expects to live 1.3 years shorter than a direct retiree of the same age.

The objective of this paper is two goals . First, we aim to verify if mortality is significantly different between the retired population and the survivor pension beneficiaries and between the different categories of survivor pensioners. The second objective is to construct experience periodic life tables for the Algerian survivor pension beneficiaries by category. Such actuarial life tables are assumed to better adjust actuarial valuations to the risk function of each category of the survivor pensioners.

1- DATA

The population of survivor pension beneficiaries is constituted of the right-holders of the deceased insured workers (or the deceased direct pensioners) as defined by the social security law n° 83-11 of 02

July 1983, modified and completed by the ordonnance 96-17 of 06 July 1996. It is composed of three subpopulations, which are:

- Surviving spouses;
- Ascendants: parents in charge earning less than 75% of the National Minimal Guaranteed Wage (NMGW);
- Orphans: children, including minors and some categories of majors such as the disabled ones, students till the age of 21, and females without incomes whatever their age.

Constructing an experience life table requires two types of data: the distribution of deaths and population at risk by sex and age. In this paper, we are interested in the population of the survivor pension (and allowance) beneficiaries. We distinguish three subpopulations: the surviving spouses, the ascendants, and the orphans.

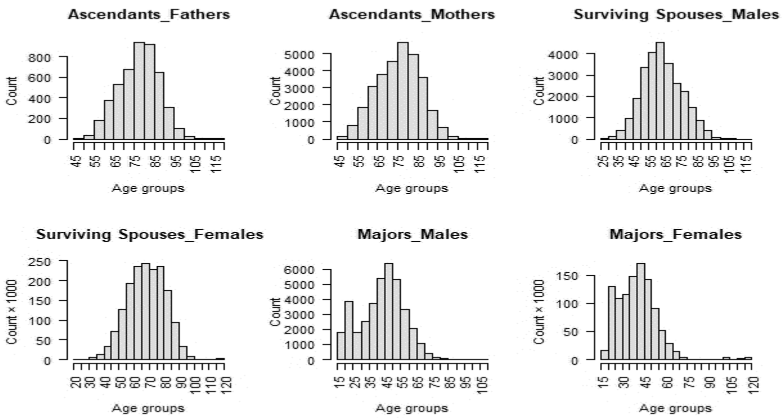
Our data comes from the "Caisse Nationale des Retraites (CNR)" which manages the salaried workers' scheme of the Algerian retirement system. By the end of 2018, the population of survivor pensioners was mainly composed of surviving spouses with a share of 56%, followed by orphans with 43%, while ascendants represent 1% only.

The available data are the number of deaths occurred at age x during the year t noted as (d_x^t), and the number of survivors aged x by the end of the year t, noted as (l_x^t), both data are disaggregated by sex. The observed years are 2016, 2017, and 2018.Due to the lack of accurate data about minor orphans, this subpopulation is excluded from being addressed in this paper.

1.1- Population at Risk

During the 2016-18 period, the population at risk was more than 2.8 million person-years. Figure 1 shows the distribution of this population by category of beneficiaries, sex, and age group.

Figure 1. Population at risk by sex, age group, and category



Data source: CNR.

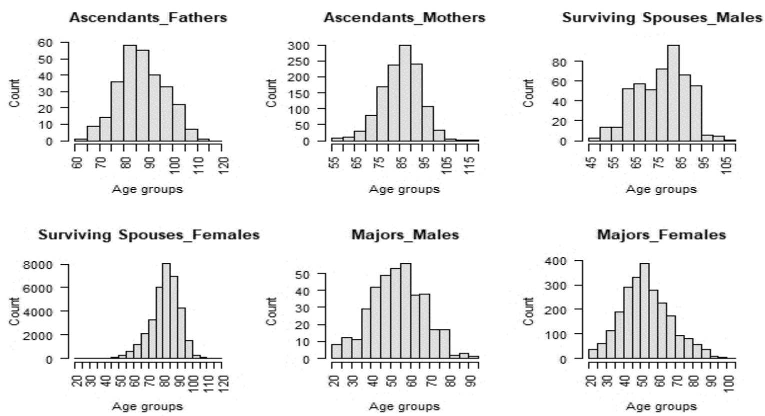
For ascendants, the total exposure reached 35,582 person-years, dominated by mothers with roughly 87%. Concerning the surviving spouses, the population at risk reached 1.7 million person-years, women take a share of 98.5%. Such a predominance of women relies mainly on the weakness of the labor force participation rate of females compared to males, 17.3% against 66.8% in 2019 (ONS, 2019). The gap was even much wider before the 2000s. Thus, men are more likely to be direct pensioners and women as survivor pensioners. In addition, the age difference in marriage, estimated at 5.9 years based on the CNR data, and the female advantage in life expectancy, estimated at 1.3 years according to ONS (2018), have an effect.

For majors, the exposure to death risk was at1.1 million person-years. It is composed mainly of females with 96.5% due to the age limit fixed by the law in concern of male orphans to benefit a survivor pension, which is 21 years. For ages beyond 21 years old, the population of male majors gathers the disabled orphans.

1.2- Distribution of deaths

Figure 2 presents the deaths recorded during the 2016-18 period, by sex and age group for each category of beneficiaries. For ascendants, the mean age at death was 86.3 years for fathers and 86.8 years for mothers. Besides, the modal age interval was [80, 85[for fathers and 85, 90for mothers). In concern of the population of surviving spouses, the mean age at death was 78.1 years for males and 82.6 years for females, with (80, 85)as a modal interval for both sexes. For majors, the average age at death was 54.15 and 54.06 years for males and females, respectively, while the modal age interval was (55, 60) for males and (50, 55)for females.

Figure 2. Deaths by sex, age group, and category



Source: CNR.

2- METHOD

Our main objective is to construct experience life tables for each category of survivor pension beneficiaries by sex. Since the population at risk is not high enough to estimate consistent age-detailed tables, we construct abridged life tables first. Then, we deduce the complete life tables using interpolation techniques.

2.1- Estimating the experience death rates

In this step, we estimate the death rates by five age intervals, during the observation period, for each category of survivor pension beneficiaries. This indicator of mortality, noted $M_{x,x+5}$, is calculated by dividing the number of deaths observed in the age interval $[x, x+5[$, that we note $D_{x,x+5}$, over the observation period, by the population at risk $L_{x,x+5}$. For each year t of the observation period, the exposure to the death risk $L^t_{x,x+5}$ is estimated by the average of the population at the end of the previous year ($l^{t-1}_{x,x+5}$) on that at the end of the current year. We can write:

$$L^t_{x,x+5} = \frac{l^{t-1}_{x,x+5} + l^t_{x,x+5}}{2}$$

For an observation period of three years, i.e., 2016-18, the five-age death rate can be calculated as follows:

$$M_{x,x+5} = \frac{D_{x,x+5}}{L_{x,x+5}}$$

$$M_{x,x+5} = \frac{\sum_{t=2016}^{2018} D^t_{x,x+5}}{\frac{1}{2}\left(l^{2015}_{x,x+5} + l^{2016}_{x,x+5}\right) + \frac{1}{2}\left(l^{2016}_{x,x+5} + l^{2017}_{x,x+5}\right) + \frac{1}{2}\left(l^{2017}_{x,x+5} + l^{2018}_{x,x+5}\right)}$$

Assuming an approximate uniform distribution deaths in the age interval $[x, x+5[$, thedeath rates $M_{x,x+5}$ can be converted into mortality rates $Q_{x,x+5}$, also denominated as the probabilities of death, using the approximation of Kimball (1960):

$$Q_{x,x+n} = \frac{2 * n * M_{x,x+n}}{2 + n * M_{x,x+n}}$$

with$n$ referring to the length of the age intervals, which equals 5 years in our case.

2.2- Fitting the crude mortality rates

The goodness-of-fit of any mortality model is strongly tied to the age range selected for model calibration. Usually, the regularity of the crude mortality rates over age is used for such a purpose. Once this interval is chosen, several models can be used to fit the mortality curves. In the literature, different mortality models have been proposed to fit different mortality measures, i.e., the mortality rate q_x, the death rate m_x,or the force of mortality μ_x.In what follows, we present the three models used in this paper using the R software: the model of Gompertz (1825), the model of Heligman & Pollard (1980) and the model of Kannisto (1992).

2.2.1. The Gompertz model

This model is based on the force of mortality (μ_x) which can be expressed as an exponential function of age x (Gompertz, 1825).

$$\widehat{\mu_x} = \alpha * \beta^x, \ \ \alpha > 0, \beta > 1$$

With α translating as the general level of mortality and β as ameasure of the evolution of the death risk by age. The linear transformation of this model leads to:

$$\ln(\widehat{\mu_x}) = \ln(\alpha) + x * \ln(\beta)$$

This function can be used to model the mortality rate beyond the age of 30 years. However, it underestimates mortality before age 40 years and overestimates it beyond the age of 80 years (CA, 2005).

2.2.2. The model of Heligman & Pollard (HP)

The model of Heligman and Pollard is the only model that fits the probability of death (q_x) at all ages, including infanthood, childhood, and young/adult ages (Heligman & Pollard, 1980). It can be written as:

$$\frac{\widehat{q_x}}{1 - \widehat{q_x}} = A^{(x+\beta)^c} + D * e^{(-E(ln(x)-ln(F))^2} + G * H^x$$

Each term of the model fits the Age Specific Mortality Rates (ASMRs) of a given age category. The third term $G * H^x$ fits the mortality rates at high ages (Heligman & Pollard, 1980). Since we are interested in mortality rates at age 40 and older, the two first terms become useless, only the third term can be kept. The linear transformation of the third term of the HP model leads to:

$$ln(\widehat{q_x}) = \pi + \theta * x$$

With $\pi = \ln(G)$ and $\theta = ln(H)$.

2.2.3. The Kannisto model

The Kannisto model is an adapted logistic model, which fits the force of mortality with age (Kannisto, 1992).

$$\widehat{\mu_x} = \frac{\alpha * e^{\beta.x}}{1 + \alpha * e^{\beta.x}}$$

The linear transformation of this model leads to:

$$log(\frac{\widehat{\mu_x}}{1-\widehat{\mu_x}}) = \ln(\alpha) + \beta * x$$

2.3- Old age mortality extrapolation

Several models can be used to extrapolate mortality rates to old ages. In our case, we retain the Denuit & Goderniaux method (2005) to extend the mortality rates of the different life tables until the age 120. This model is based on a quadratic function of the log mortality rates:

$$\ln(\widehat{q_x}) = a + bx + cx^2$$

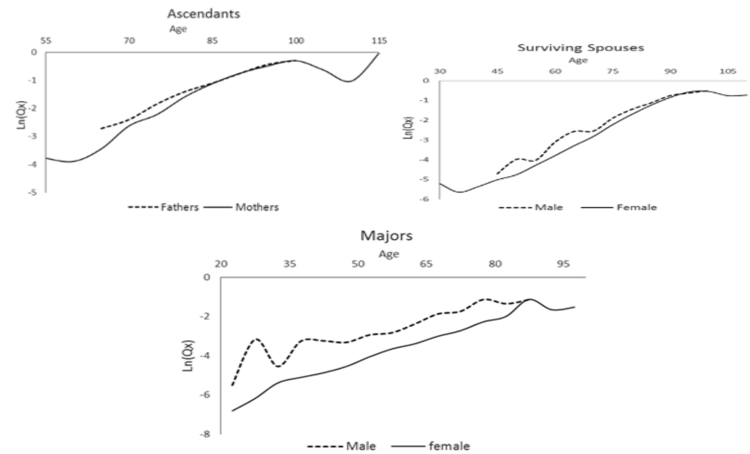
The parameters a, b and c are estimated by the Least Squares Method. First, the choice of such a model relies on its higher predictive capacity compared to the linear transformed models (Flici, 2020). To avoid obtaining an uncoherent predicted age limit, Denuit and Goderniaux (2005) imposed a closing constraint at age 130 by setting $q_{130} = 1$. In our case, we set the closing age at 120 years. This value is based on the results of the Multiple Indicator Cluster Survey, wave 4 (MICS-4), conducted in 2012-13 by the United Nations International Children Emergency Fund (UNICEF) in collaboration with the Algerian Ministry of Health. The survey allowed observing some survivors aged 112 years among women and 110 years among men (Flici and Hammouda, 2016). Accordingly, Flici (2020) suggested the age of 120 as an age limit for closing-out Algerian life tables.

3- RESULTS AND DISCUSSION

3.1- Estimation of experience death rates

First, we estimated the crude death rates by five age intervals for the three subpopulations. Then, we converted them into mortality rates. The obtained curves are presented in Figure 3.

Figure 3. The curves of mortality rates by five-age intervals



Data source: CNR.

As shown in Figure 3, the evolution of the mortality rates over age, for the three subpopulations, shows some irregularities. Therefore, the crude mortality curves need to be fitted to obtain more regular age patterns.

3.2- Fitting mortality rates

3.2.1. The age intervals used for fitting

The low availability of mortality data below age 65 for ascendants, 45 for male surviving spouses, 60 for female surviving spouses, 45 for majors-males and 40 for majors-females, results in an irregular age-pattern of mortality rates. Also, this irregularity is observed beyond age 90, 95, 90, 70 and 80 for ascendants, male surviving spouses, female surviving spouses, majors-males and majors-females, respectively. Including these age categories in models' calibration leads to increase the uncertainty of the model parameters. Consequently, we consider only the rates belonging to the age intervals $[65, 90[$ for ascendants both fathers and mothers, $[45, 95[$ for male surviving spouses, $[60, 90[$ for female surviving spouses, $[45, 70[$ for majors-males, and $[40, 80[$ for majors-females.

3.2.2. Model selection

The selection of an estimated "best-approximating model" is a well-known problem in statistics. According to Lebarbier and Mary-Huard (2004), one of the solutions proposed by statisticians is the minimization of a penalized criterion. The first criteria that have been used in the literature are the Akaike Information Criterion (AIC) by Akaike (1973), the Bayesian Information Criterion (BIC) by Schwartz (1978), and the Minimum Description Length (MDL) by Rissanen (1978). Among these criteria, the AIC and the BIC are widely used. AIC is recommended to compare models based on a different number of parameters, whereas BIC considers the number of observations in addition to the number of parameters. In our case, since the three models are based on the same number of observations, the use of AIC is preferred.

In the case of linear models estimated by the Least Square Method, with normally distributed errors and constant variance, as in our case, AIC can be expressed as (Burnham and Anderson, 2002):

$$AIC = n * \log(\hat{\sigma}^2) + 2 * k = n * \log\left(\frac{SSE}{n}\right) + 2 * k$$

With k is the total number of the estimated regression parameters, including the intercept, $\hat{\sigma}^2$ represents the variance of the model, and SSE is the Sum of Squared Errors, calculated by: $SSE = \sum\ [ln(q_x) - ln(\hat{q}_x)]^2$.

The estimated "best approximating model" selected from a set of candidate models corresponds to the model with the lowest value of AIC (Burnham and Anderson, 2002). The corresponding values of AIC obtained for different subpopulations are shown in the Table 1.

Table 1. Models comparison

Models	Gompertz	Kannisto	Heligman & Pollard
		Ascendant fathers	
AIC	-11.94	-12.12	-11,27
(**Rank**)	(2)	(1)	(3)
		Ascendant mothers	
AIC	-6.54	-7.68	-8.68
(**Rank**)	(3)	(2)	(1)
		Male surviving spouses	
AIC	-1.49	-2.08	-2.09
(**Rank**)	(3)	(2)	(1)
		Female survivng spouses	
AIC	-21.93	-21.15	-16.83
(**Rank**)	(1)	(2)	(3)
		Majors males	
AIC	-4.9	-4.58	-4.12
(**Rank**)	(1)	(2)	(3)
		Majors females	
AIC	-22	-22.23	-22.43
(**Rank**)	(3)	(2)	(1)

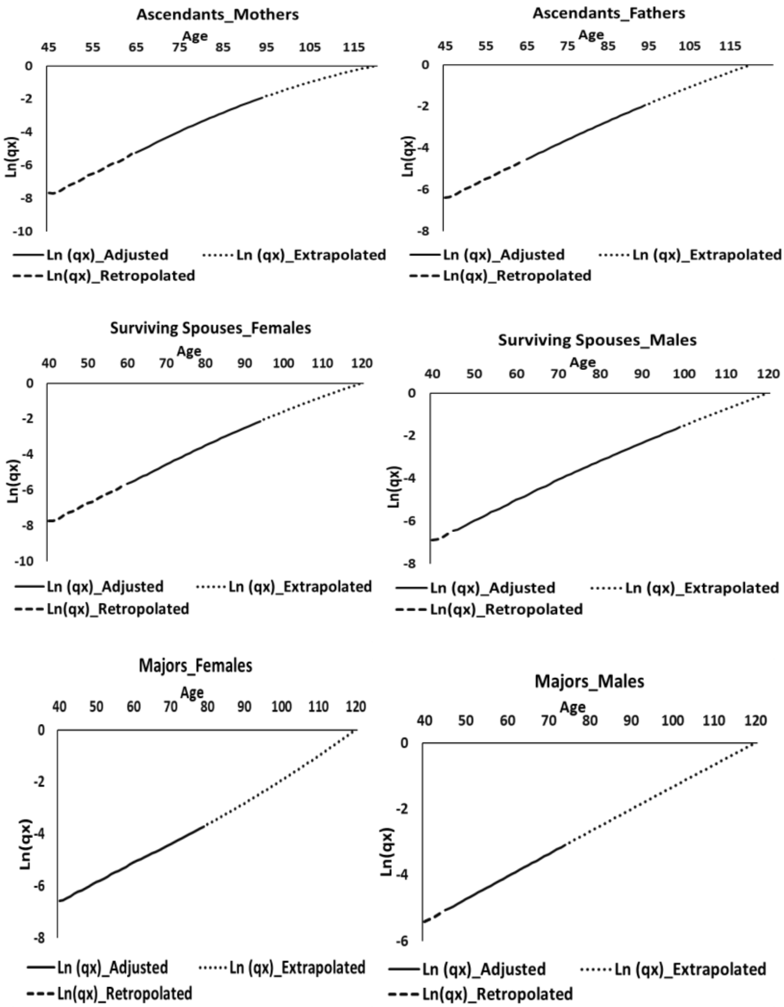
Data Source: CNR (2019)

We note that the Kannisto model is the estimated "best-approximating model" that fits better mortality rates of fathers. For mothers, mortality rates are better fitted by the HP model. Concerning surviving spouses, the HP and Gompertz models are the "best-approximating model" for males and females respectively. For majors, mortality rates of males are better fitted via the Gompertz model. Whereas, mortality rates of females are better fitted by the HP model.

3.2.3. Retropolation, interpolation and extrapolation of mortality rates

After being fitted by a parametric model, the mortality rates were retropolated, interpolated and extrapolated to old ages. The different curves are shown in Figure 4.

Figure 4. Retropolation and extrapolation of the age specific mortality rates



Data source: CNR (2019)

Although mortality data is available starting from age 48 and 47 for fathers and mothers, respectively, from 29 and 23 years for the surviving spouses, males and females, and age 18 for the majors, mortality models were fitted starting from relatively higher ages for regularity matters. To recover the information loss generated by such a process, we retropolated the estimated mortality rates to lower ages using the parameters of the models already estimated. However, we preferred the retropolation to be done until the age of 45 years for ascendants, and 40 years for surviving spouses and majors only. Below these ages, mortality rates have a different pattern and cannot be correctly estimated using models like those proposed by Gompertz or Kannisto.

3.2.4. Models validation

The process of validation of a life table involves several criteria. In our case, we retain three: confidence interval for deaths, mortality sex ratio (MSR), and comparison to the life tables specific to direct pension beneficiaries.

Confidence interval for deaths Expected mortality sex ratio (MSR)

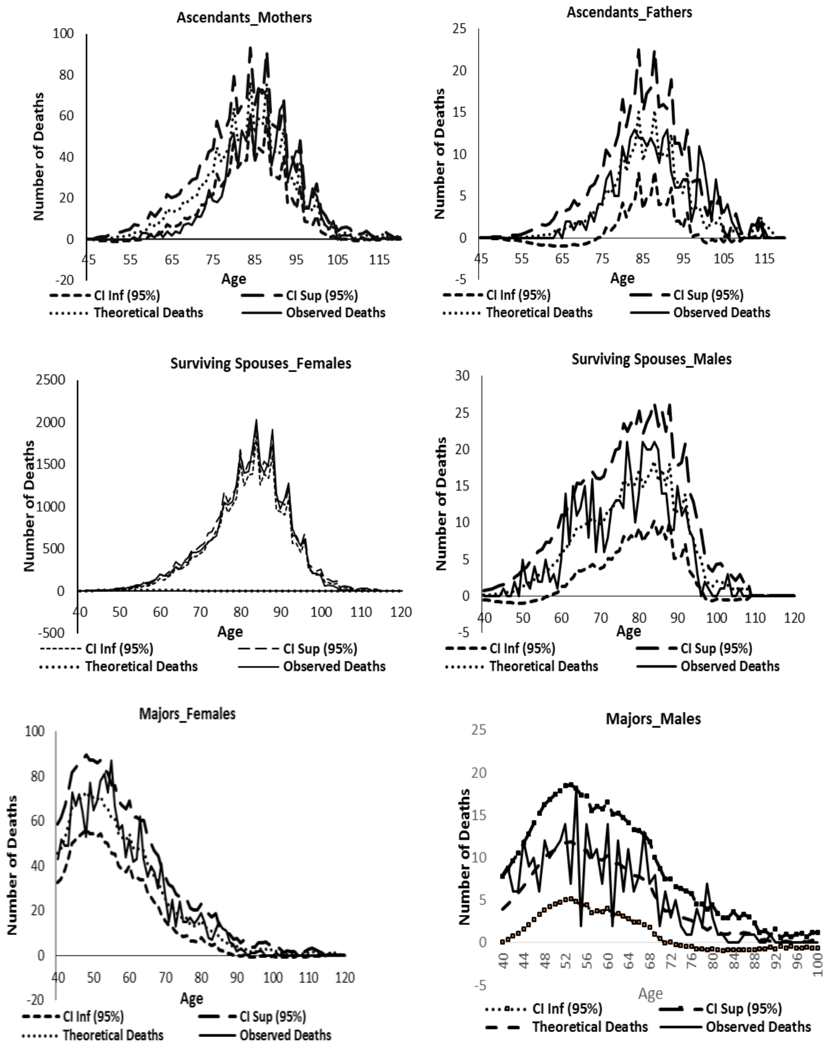
The number of deaths follows a binomial distribution (Planchet & Thérond, 2006). Using the approximation to the normal distribution, the Age Specific Death Rates (ASDRs) follow a normal distribution with a mean $\widehat{m}_x$ and a variance $\frac{\widehat{m}_x \times (1-\widehat{m}_x)}{L_x}$ (Planchet & Kamega, 2013). The confidence intervals of the estimated ASDRs, for a confidence level of $(1-\alpha)$, are given by the following formula:

$$P\left(m_x \in \left[\widehat{m}_x \pm \mu_{\alpha/2} \times \sqrt{\frac{\widehat{m}_x \times (1-\widehat{m}_x)}{L_x}}\right]\right) = 1-\alpha$$

$\widehat{m}_x$: estimated age-specific death rates;
m_x: observed age-specific death rates;
L_x: population at risk;
$\mu_{\alpha/2}$: quantile of the normal distribution.

Figure 5 shows the obtained confidence intervals for the three subpopulations by sex.

Figure 5. Confidence intervals of the number of deaths at 95%



Data source: CNR.

The estimated confidence intervals reveal that the observed deaths of mothers, those of the male surviving spouses, and those of the female majors are comparable to the theoretical deaths issued from the experience tables, which translates as a sign of fidelity of the models to the observed mortality experience. Concerning the population of fathers, the observed deaths are generally inside the confidence interval. For ages beyond 99 years, the observed deaths exceed theoretical deaths. For the populations of the female surviving spouses and the male majors, we observe that the distribution of deaths is not comparable to the theoretical deaths at certain ages. Many ages show mortality over or underestimation, particularly ages 55, 61, 79 years and beyond age 81 years for the male majors and the female surviving spouses, respectively.

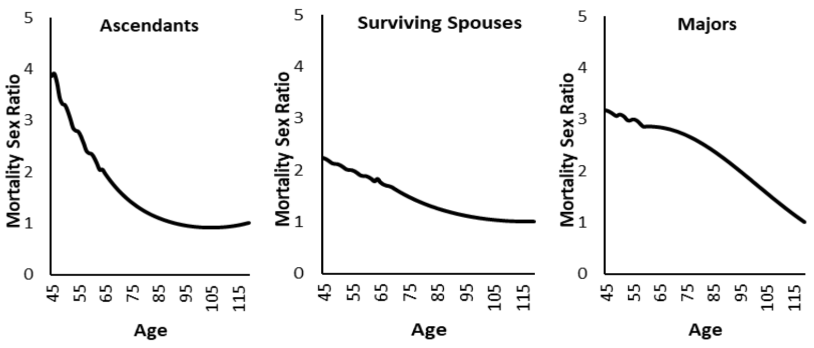
Expected mortality sex ratio (MSR)

The mortality sex ratio represents the ASMRs of males divided by those of females:

$$MSR = \frac{q_x^{male}}{q_x^{female}}$$

The regularity of the evolution of this ratio is a sign of the quality and coherence of mortality rates estimated by sex (Flici et al., 2017). Figure 6 shows the evolution of the different ratios by age and type of beneficiaries.

Figure 6. Evolution of mortality sex ratio by age and category



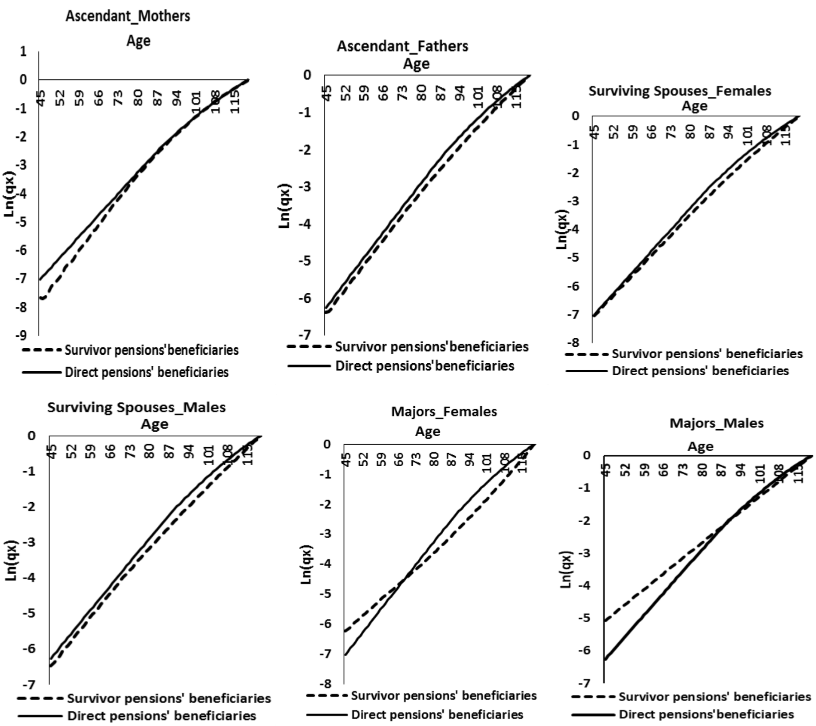
Data source: CNR.

We observe that the MSR decreases with age and reaches 1 by 120 years old, representing some irregularities at certain ages. Since the observed death rates are not comparable to the theoretical deaths for the fathers, the female surviving spouses, and the male majors, we cannot focus solely on this criterion to measure the coherence of the estimated mortality rates by sex.

Comparison to the life tables specific to direct pension beneficiaries

In Figure 7, we compare the constructed life tables for the three subpopulations, to those specific to direct pension beneficiaries by sex.

Figure 7. Comparison of mortality rates by sex – direct retirees versus survivor pensioners



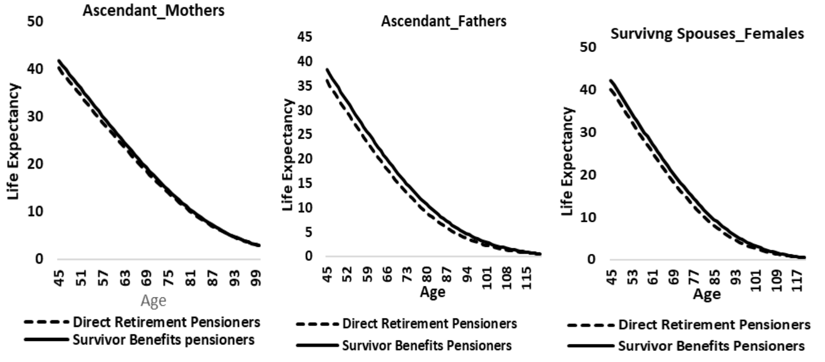
Data source: CNR.

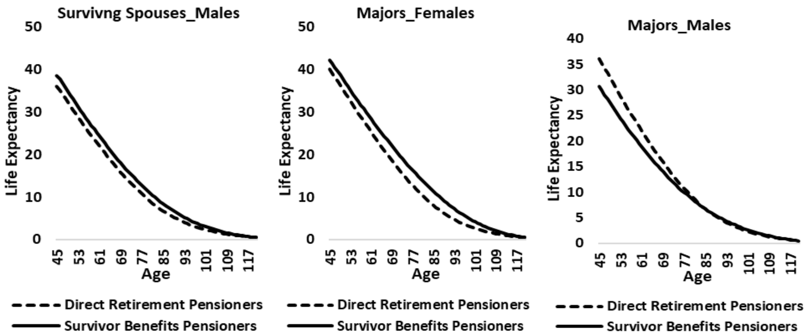
According to the different confidence intervals already presented, only the experience life tables of the mothers, the male surviving spouses, and the female majors represent correctly the observed mortality experience. The estimated mortality rates of the other categories are outside the confidence intervals at several ages. Consequently, we will limit to analyze the comparison results of only these three subpopulations.

We note that the mortality of the mothers is approximately equal to that of direct pension beneficiaries beyond the age of 80 years. At the age of 60 years, the difference is about 36%. Concerning the male surviving spouses, the mortality level is lower than that of direct retirees at all ages. At the age of 45 years, the gap is about 18%. For the female majors, the mortality rates are higher than that of the direct retirees before age 65 and lower beyond this age.

In terms of life expectancy, a surviving mother aged 45 years expects to live around 1.63 years longer than a female direct retiree of the same age. The male surviving spouses have an advantage of around 2.6 years at age 45 compared to the male direct retirees. The gap is slightly lower for the female majors compared to the female direct retirees with 2.16 years.

Figure 8. Comparison of life expectancies by sex - direct retirees versus survivor pension beneficiaries





Data source: CNR (2019)

3.2.5. Results discussion

Using parametric models to fit the crude mortality rates of the Algerian survivor pensioners gave in overall good estimates for the population of the mothers, of the male surviving spouses, and of the female majors. For fathers, female surviving spouses and male majors, the estimates are of a lower quality.

The Heligman-Pollard model, which was the best model to fit mortality rates of the mothers, the male surviving spouses, and the female majors, gave overall good results. Moreover, the mortality level is different between these categories of survivors and between the survivors and direct retirees. To explore the reasons behind this mortality disparity, we need to investigate further information about socioeconomic characteristics like education level and career earning or pension amount (Bosworth & Burke, 2014). In addition, health conditions difference can also explain this mortality gap. Since this information is not available in the database provided by CNR, we cannot examine the sources of mortality variation between the different types of beneficiaries.

The Kannisto model, selected as the best model for the population of the fathers, gave estimations of a lower quality beyond the age of 99 years. For Gompertz model, it gave also lower quality estimates for the female surviving spouses and the male majors. Consequently, the estimations given by these two models have to be improved by including the mortality data observed during the years before 2016 and by using more sophisticated methods like the relational models.

CONCLUSION

This paper aimed to estimate experience life tables for the different categories of the Algerian survivor pension beneficiaries. Such tables are necessary for retirement plan management and more accurate actuarial valuations. Flici and Planchet (2019) demonstrated that the mortality of the female retirees receiving direct pensions is lower than that of the global female population, while no significant difference was observed for males. In this work, we aimed to verify if mortality is also different between the categories of Algerian survivor pension beneficiaries and to estimate life tables by category of pensioners. Our approach was based on parametric mortality modeling. Three models were evaluated and compared: the Gompertz model, the Kannisto model, and the model of Heligman & Pollard.

The obtained results show that only the experience life tables for the populations of the mothers, the male surviving spouses, and the female majors were correctly represented by the estimated life tables. The estimated distributions of deaths are comparable to the observed deaths for the cited categories. On the other hand, the estimated life tables were of low quality for the populations of the female surviving spouses, the male majors, and the fathers. Moreover, the results show that the mortality is different between the different categories of survivors and between the survivors and direct retirees. However, exploring the sources of this mortality disparity needs further information about the socioeconomics characteristics of the pensioners, which are not available in the database provided by CNR.

To finish, the mortality is significantly different between the categories of the Algerian survivor pensioners. However, only the experience life tables of the mothers, the male surviving spouses, and the female majors are validated. To improve the estimation quality for the other subpopulations, it is recommended to construct prospective life tables using a mortality database of at least 10 years length and a more sophisticated approach, which can be that of relational models.

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