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# Mortality among married older adults in the suburbs of Beirut: estimates from offspring data

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**Objective** Countries in transition are characterized generally by poor statistical infrastructures and a dearth of vital information. In this study we use offspring data to examine mortality trends in married older men and women through a multipurpose household survey conducted in 2002 in the suburbs of Beirut, Lebanon. The country had been ravaged by war for almost 16 years.

**Methods** A random sample of 1520 respondents, with either or both parents surviving their 65th birthday, provided information on 1172 fathers and 1108 mothers. Age- and sex-specific mortality rates per 1000 person-years were estimated. Using log-linear Poisson regression, mortality risk was examined for three birth cohorts: those reaching age 65 before (pre-1975), during (1975–1990) and after (post-1990) hostilities in the country.

**Findings** A total of 1037 parental deaths were reported, yielding an overall mortality rate of 48.7 per 1000 person-years (51.4 among males and 45.3 among females). Compared to the pre-1975 cohort, older adults reaching age 65 during the war years, 1975–1990, had the highest mortality risk for both males (rate ratio, RR = 1.48, 95% confidence intervals, CI = 1.07–2.04) and females (RR = 1.22, 95% CI = 0.95–1.58). Mortality risk was significantly higher in males than females, a gender differential notably largest in the 1975–1990 cohort.

**Conclusion** This is the first population-based study in Lebanon to quantify patterns of mortality in cohorts of married older adults. The results suggest that the hostilities may have contributed to decreased survival, particularly among males. The approach used in the study presents a viable option for testing in larger surveys and population censuses in countries that lack reliable statistical infrastructures.

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Une traduction en français de ce résumé figure à la fin de l'article. Al final del artículo se facilita una traducción al español. الترجمة العربية لهذه الخلاصة في نهاية النص الكامل لهذه المقالة.

## Introduction

In recent decades, older individuals have been the fastest-growing population segment worldwide. Compared to the industrialized world, the increase in the number and proportion of older adults in several developing countries is taking place at an accelerated pace that outstrips traditional welfare-support mechanisms. Unfortunately, these issues remain largely unrecognized by policy-makers and generally are under-researched in poorer settings.<sup>1,2</sup> This is exacerbated by a lack of reliable data sources resulting in a dearth of information.

Lebanon, a small middle-income country (total population around 3.6 million) on the eastern Mediterranean coast, is such a case. It lacks national data on mortality in its older population. The health system in the country is characterized by a poor statistical infrastructure,<sup>3</sup> attributable in part to a lack of financial and technical resources

caused by the war that ravaged the country from 1975 until 1990.

When conventional data sources are unavailable or inadequate and resources are limited, several alternative approaches have been developed to derive estimates of mortality based on information about the survival of the respondents' close kin.<sup>4–6</sup> Recently, a modified but comparable technique using sibling<sup>7</sup> and widowhood data<sup>8</sup> has been used to estimate adult mortality in the Russian Federation. Using offspring data from a multipurpose household survey, we examined patterns of mortality in periods before, during (1975–1990) and after the war in several birth cohorts of older married men and women in Beirut.

## Methods

### Subjects and measurements

A cross-sectional multidimensional survey of three communities in the suburbs

of Beirut was conducted in the spring of 2002 by the Center for Research on Population and Health of the American University of Beirut. The three communities (Hay el-Sellom, Naba'a and Bourj el-Barajneh) together have an estimated 150 000 inhabitants and are characterized overall by poor housing conditions. More than 50% of respondents to the survey in each community perceived themselves to be poor, and a large proportion of the study population was displaced as a result of the 16 years of civil war and regional conflicts. The three communities differed in their ethnic backgrounds. Residents of Hay el-Sellom and Naba'a were mostly Lebanese (over 92%); most of those in Bourj el-Barajneh were Palestinian refugees who were forced to leave their towns and villages as a result of the 1948 Arab–Israeli war.

The details of the design and conduct of the survey are presented elsewhere.<sup>9</sup> Briefly, a random sample of

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households was selected from randomly drawn primary sampling units proportional to population size. From a total of around 3470 households selected, 120 refused to be interviewed and 276 could not be contacted. This yielded an overall response proportion of 88.6%. Face-to-face interviews were conducted with an adult member of each household who was asked to report any parent who had survived beyond 65 years of age. Those who did so were asked when their parents were born, whether any were still alive at the time of the interview and, if not, to give their ages and years of death. The study protocol was approved by the Institutional Review Board (IRB) of the American University of Beirut.

### Statistical methods

Only parents who survived their 65th birthdays were included in this analysis. Age was considered in seven five-year groupings and was treated as a time-dependent variable with subjects contributing person-years to multiple age groups. Age- and sex-specific mortality rates per 1000 person-years were estimated by dividing the number of death events over total observation time for each subject, the latter calculated from age 65 until censoring. Censoring was defined as either a change in the age stratum or the end of the study period, whichever came first. A total of 12 records with incomplete data on vital status or age were excluded from the analysis. Using log-linear Poisson regression, mortality risk was examined for three broad categories of cohorts corresponding to those reaching age 65 in the years prior to (pre-1975), during (1975–1990) and after (post-1990) the eruption of armed conflict in the country, while controlling for age. Rate ratios (RR) and their 95% confidence intervals (CI) were calculated by comparing risks of mortality in the latter two cohorts using the pre-1975 cohort as baseline. Using weighted data, analysis was stratified by gender. The S-PLUS statistical package (2000) was used for all analyses.

### Results

A total of 1520 respondents, with a mean age of 47 years and predominantly female (77%), gave information on either (403 fathers, 339 mothers) or both of their parents (769 fathers, 769 mothers). The majority of respondents (58%) had attained only elementary

level education – equivalent to nine years of schooling. There was no association between the respondents' gender or education and whether both or either parent had reached their 65th birthday. However, respondents' ages were significantly higher when both parents had lived beyond 65 years than when either parent was younger at the time of the survey (50 years versus 45 years,  $P$ -value < 0.05).

Information from the respondents contributed to the final analysis of mortality for 1172 fathers and 1108 mothers. A total of 1037 parental deaths were reported (613 fathers, 424 mothers). Their mean age at death was 77 (standard deviation, SD = 9.5 years) and 76 years (SD = 8.3 years), respectively.

Table 1 presents the percentage of deaths and mean age at death within each cohort stratified by community and gender. By the time of the data collection in 2002, almost all of the pre-1975 cohort members had died. Consequently, age at death was highest in this cohort – approaching 82 among both men and women. The larger the proportion of deaths, whether across cohorts or between genders, the higher was the mean age at death. There was no significant difference in either the mortality risk or mean age at death across the three communities.

Males had significantly higher mortality than females (51.4 and 45.3 per 1000 person-years, respectively) with a rate ratio of 1.14 and 95% CI of 1.01 to 1.28. Survival decreased consistently with age and was lower for men than women in the younger age groups. Results of the Poisson regression in males showed that those who reached age 65 between 1975 and 1990 had a significantly higher mortality risk compared to the baseline (pre-1975) (RR = 1.48, 95% CI = 1.07–2.04); the post-1990 cohort exhibited a similar risk (RR = 1.16, 95% CI = 0.72–1.86). A similar trend was observed among females, albeit the results did not reach statistical significance (RR = 1.22, 95% CI = 0.95–1.58 and RR = 1.01, 95% CI = 0.56–1.82, respectively). Differentials in mortality by gender were notably higher for the 1975–1990 cohort (Fig. 1).

### Discussion

Borrowing from demographers' techniques, the application of the indirect approach presented an opportunity to estimate mortality risk among older

adults. Such techniques are used widely to estimate child,<sup>10</sup> maternal<sup>5,6</sup> and, more recently, adult mortality<sup>7,8,11</sup> but we are unaware of any investigations of older adult mortality. Based on the reporting of 1520 adults in the suburbs of Beirut, the overall mortality of their parents who had reached the age of 65 was 51.4 per 1000 person-years for males and 45.3 per 1000 person-years for females. These yielded overall mortality of 48.7 per 1000 person-years. Owing to the limitations of the country's vital registration system, it is difficult to compare our findings with those obtained from more traditional sources of mortality data, such as death certification. Nevertheless, the study methodology provided reasonable estimates when compared with mortality estimated from an earlier population-based cohort study conducted in Beirut between 1984 and 1994 among older men (44.7 per 1000 person-years) and women (36.0 per 1000 person-years) aged 60 years and over.<sup>12</sup> Similarly, the mean ages at death attained in our study for subjects who had completed their life cycles (the pre-1975 cohort) (82.4 years for men and 81.7 years for women, Table 1) are comparable with those based on life expectancy calculations using current life-table techniques (80.9 years and 81.8 years, respectively).<sup>13</sup> Both comparisons suggest that our study methodology and findings provide reasonable estimates of mortality statistics among older adults in Lebanon.

Mortality was highest in the birth cohorts reaching age 65 between 1975 and 1990, the period of war in Lebanon. It is difficult to establish whether this is attributable to the prevalent hostilities. Nevertheless, the traumatic events of the civil war affected the majority of the population by altering and changing the timing of normal life-course trajectories, such as health decline and retirement. The experience of war can be especially disruptive to an older adult, particularly while attempting to accommodate normative but significant life-course transitions.<sup>14</sup> Hence in our study, those approaching old age during the Lebanese wars may have faced untimely life transitions, such as early widowhood, forced retirement, displacement and enduring financial problems that weakened their coping capacities and predisposed them to higher mortality risk. Earlier research work conducted in Beirut during wartime indicated that war stressors have a

Table 1. Proportion of deaths and mean age at death, within each cohort in three Beirut communities by community and gender

Community	Men			Women		
	% deaths	Mean age at death ± SD	P-value	% deaths	Mean age at death ± SD	P-value
<b>Before hostilities (pre-1975) cohort</b>						
Hay el-Sellom	98	83.2 ± 10.6	0.679	93	82.7 ± 10.9	0.829
Naba'a	97	82.3 ± 10.2	–	98	81.5 ± 9.2	–
Bourj el-Barajneh	96	82.3 ± 10.0	–	100	81.3 ± 7.1	–
Subtotal	97	82.4 ± 10.2	–	98	81.7 ± 9.0	–
<b>During hostilities (1975–1990) cohort</b>						
Hay el-Sellom	68	75.6 ± 6.5	0.190	60	75.2 ± 6.0	0.393
Naba'a	65	74.6 ± 6.5	–	63	75.3 ± 6.1	–
Bourj el-Barajneh	73	73.5 ± 6.1	–	69	74.0 ± 6.6	–
Subtotal	68	74.4 ± 6.4	–	64	74.8 ± 6.3	–
<b>After hostilities (1990–2003) cohort</b>						
Hay el-Sellom	9	68.9 ± 2.0	0.393	6	68.6 ± 3.5	0.483
Naba'a	17	67.8 ± 2.5	–	12	67.8 ± 3.0	–
Bourj el-Barajneh	16	68.0 ± 2.8	–	15	69.1 ± 3.8	–
Subtotal	14	68.1 ± 2.5	–	10	68.6 ± 3.5	–
<b>All cohorts</b>						
Hay el-Sellom	39	78.1 ± 9.6	0.476	31	76.0 ± 9.2	0.110
Naba'a	51	76.9 ± 9.5	–	34	76.8 ± 8.4	–
Bourj el-Barajneh	55	76.8 ± 9.4	–	41	75.0 ± 7.6	–
<b>Total</b>	<b>52</b>	<b>77.1 ± 9.5</b>	<b>–</b>	<b>38</b>	<b>76.0 ± 8.3</b>	<b>–</b>

SD, standard deviation.

disproportionately larger adverse effect on those with lower socioeconomic status and, consistent with our findings, the relationship is stronger in men than women.<sup>15</sup> Furthermore, and because of the age-selection criteria imposed on the subjects included in the analysis (over 65 years), our findings are more likely to reflect an examination of period effect concurring with the war atrocities than a cohort effect of early environmental exposures. At the time this report was completed (July 2006) the country was ravaged by another war, resulting in over 1180 deaths and around 4500 wounded, nearly all civilians. With an overall economic loss of at least US\$ 15 billion, this was one of the most devastating wars in Lebanon's recent history; the toll on civilian life in terms of unemployment, displacement, poverty and psychosocial consequences has yet to surface.

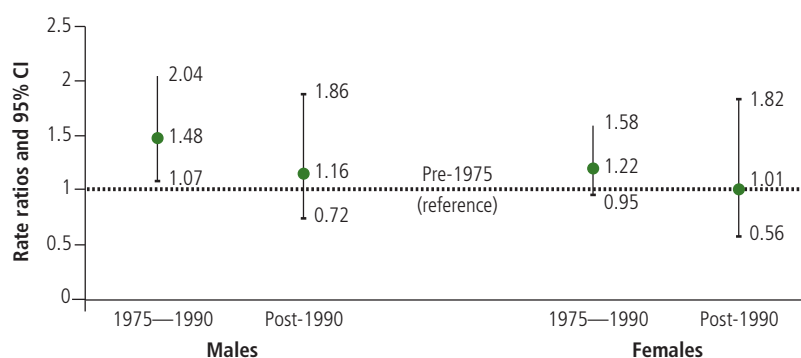
Similar to other indirect techniques, the offspring method yields retrospective estimates with the reference point in time dependent on the respondent's age group, the most recent being derived from the youngest.<sup>5</sup> It is possible that those providing data on a year of death that occurred early in the study period

have poorer recall. Furthermore, the method relied on a sample of offspring reporting on parents, a selection bias that limited the study sample because it excluded those older adults who had never had children. Nevertheless, the effect of this selection bias may not be so marked in this context: national data indicate that less than 5% of all elderly Lebanese people have never married.<sup>16</sup> Earlier work consistently has shown that mortality differs by the

social status of study subjects and that those with lower socioeconomic status are disadvantaged.<sup>7,17</sup> While this is a worthy research question, the advantage gained by eliciting information on the socioeconomic status of the parents may be offset by the likelihood of recall bias from proxy respondents, the offspring in this case.

Consistent with many developing countries, Lebanon has a notable lack of reliable national estimates of mortality

Fig. 1. Rate ratios and 95% confidence intervals (CI) comparing mortality risks for the 1975–1990 and post-1990 cohorts with the pre-1975 baseline among older married males and females



for comparison with the figures from this study. Vital registration is neither complete nor reliable, and the only census was conducted in 1932.<sup>3</sup> For this reason, basic demographic indicators necessarily rely upon indirect estimates, and population data published in national and international statistical reports remain largely unreliable.<sup>18</sup> For the period between 1990 and 1995, for example, estimates for life expectancy at birth in Lebanon were reported variously at between 67 and 75 years.<sup>19</sup> Estimates – often extrapolated from other settings – fail to recognize significant particularities within countries and may result in misleading appraisals of their health status.

The study subjects for this investigation were selected from an urban setting. This limited our ability to generalize the results to the entire population,

even though the majority of Lebanese live in urban areas (88%, according to a United Nations report in 1999).<sup>20</sup> Nevertheless, this study provides the first population-based data available in Lebanon to quantify patterns of mortality experienced in birth cohorts of the married older population. The approach used in this study presents a viable option to be tested in larger surveys and population censuses in countries with inadequate statistical infrastructures.

## Conclusions

Other research has established that countries in transition are characterized generally by poor statistical infrastructures and a dearth of vital statistical information. Often mortality statistics are extrapolated from other settings, thus failing to recognize particularities within countries and yielding highly uncertain

results. This research adds to this body of knowledge by using offspring data. The results from this population-based study in Lebanon quantify patterns of mortality in several cohorts of married older adults, and suggest that the armed conflict in the country from 1975 to 1990 may have contributed to higher mortality. ■

## Acknowledgment

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**Competing interests:** None declared.

## Résumé

### Mortalité chez les adultes âgés mariés vivant dans les banlieues de Beyrouth : estimations obtenues à partir de données relatives à la descendance

**Objectif** Les pays en transition sont généralement caractérisés par des infrastructures statistiques de mauvaise qualité et par le manque d'informations essentielles. Nous avons utilisé ici des données concernant la descendance pour étudier les tendances de la mortalité chez les hommes et les femmes âgés et mariés, à travers une enquête multi-objectifs auprès des ménages, menée en 2002 dans les banlieues de Beyrouth au Liban, un pays ravagé par près de 16 années de guerre.

**Méthodes** A partir d'un échantillon aléatoire de 1520 personnes interrogées, dont l'un ou l'autre des parents, voire les deux, avaient dépassé 65 ans, on a obtenu des informations sur 1172 pères et 1108 mères. On a estimé les taux de mortalité par âge et par sexe pour 1000 personnes-ans. Puis on a analysé le risque de mortalité par régression (log-linéaire) de Poisson sur trois cohortes constituées en fonction de la période de naissance, à savoir les personnes ayant atteint l'âge de 65 ans respectivement avant, pendant (1975-1990) et après les hostilités dans le pays.

**Résultats** Au total, 1037 décès parentaux ont été rapportés, ce qui a permis de déterminer un taux de mortalité global de

48,7 pour 1000 personnes-ans (51,4 parmi les hommes et 45,3 parmi les femmes). Par rapport à la cohorte de personnes ayant atteint 65 ans avant 1975, ce sont les adultes parvenus à 65 ans pendant les années de guerre (1979-1990) qui présentaient les plus forts taux de mortalité, qu'il s'agisse des hommes [rapport de proportion = 1,48 ; intervalle de confiance à 95% (IC) = 1,07-2,04] ou des femmes [rapport de proportion = 1,22, IC à 95 % = 0,95-1,58]. Le risque de mortalité était significativement plus élevé chez les hommes que chez les femmes, une sexospécificité notablement plus importante pour la cohorte ayant atteint 65 ans entre 1975 et 1990.

**Conclusion** Il s'agit de la première étude en population menée au Liban pour quantifier les schémas de mortalité parmi des cohortes d'adultes âgés et mariés. Ses résultats laissent à penser que les hostilités ont contribué à réduire le taux de survie, en particulier chez les hommes. La démarche utilisée représente une solution viable à tester dans des enquêtes de plus grande envergure ou dans des recensements de population ayant pour cadre des pays manquant d'infrastructures statistiques fiables.

## Resumen

### Mortalidad de personas de edad casadas en las afueras de Beirut: estimaciones basadas en datos de descendencia

**Objetivo** Los países en transición adolecen en general de unos servicios de estadística deficientes y de unos sistemas de registro civil poco informativos. En este estudio utilizamos datos aportados por la descendencia para analizar la evolución de la mortalidad entre la población de hombres y mujeres de edad casados mediante una encuesta de hogares polivalente realizada en 2002 en las afueras de Beirut, Líbano. Este país sufrió una guerra que duró casi 16 años.

**Métodos** Una muestra aleatoria de 1520 entrevistados, de los

que al menos uno de los progenitores había llegado a cumplir 65 años, proporcionaron información sobre 1172 padres y 1108 madres. Se estimaron las tasas de mortalidad por edad y sexo por 1000 años-persona. Se usó la regresión logarítmico-lineal de Poisson para analizar el riesgo de mortalidad para tres cohortes de nacimiento, definidas según se hubieran alcanzado los 65 años antes, durante (1975-1990) o después de las hostilidades registradas en el país.

**Resultados** Se declararon en total 1037 defunciones de



progenitores, lo que arroja una tasa de mortalidad global de 48,7 por 1000 años-persona (51,4 en los hombres y 45,3 en las mujeres). En comparación con la cohorte anterior a 1975, los adultos mayores que alcanzaron los 65 años durante los años de la guerra, 1975–1990, presentaron el mayor riesgo de mortalidad tanto en el caso de los hombres (razón de tasas, RT = 1,48, intervalo de confianza (IC) del 95% = 1,07-2,04) como en el de las mujeres (RT = 1,22, IC95% = 0,95-1,58). El riesgo de mortalidad fue significativamente mayor en los hombres que en las mujeres, y esa diferencia era especialmente

marcada en la cohorte de 1975-1990.

**Conclusión** Este estudio es el primero realizado en el Líbano para cuantificar las pautas de mortalidad en cohortes de personas de edad casadas. Los resultados indican que las hostilidades pueden haber contribuido a reducir la supervivencia, sobre todo entre los hombres. El enfoque utilizado en el estudio es una opción viable a ensayar en encuestas y censos de población más amplios en los países que carecen de infraestructuras de estadística fiables.

## ملخص

### معدل الوفيات بين المسنين المتزوجين في ضواحي بيروت: تقديرات من معطيات مستمدة من أولادهم

**الهدف:** تتسم البلدان التي تمر بفترة تحول بني أساسية إحصائية سيئة بشكل عام، وبشح المعلومات حول الأحوال المدنية. وقد استخدمنا في هذه الدراسة المعطيات المستمدة من الأولاد للتعرف على اتجاهات الوفيات لدى المسنين المتزوجين والمسنات المتزوجات، من خلال مسوحات متعددة الأغراض للسكان أجريت في عام 2002 في ضواحي بيروت، في لبنان الذي تعرّض للخراب بسبب الحروب على مدى 16 عاماً مضت.

**الطريقة:** أسهم المشاركون في عينة عشوائية تتألف من 1520 من المستجيبين للدراسة، ممن بقي أبائهم وأمهاتهم على قيد الحياة حتى سن الخامسة والستين، بتقديم معلومات عن 1172 أباً و1108 أمهات، وقدّرت معدلات الوفيات الخاصة بالجنس والعمر لكل ألف شخص - سنة، واستخدم التحوف الخطي اللوغاريتمي لبيوسون للتعرف على اختطار الوفيات في ثلاث مجموعات أتراب متماثلة في وقت الولادة، والمجموعة الأولى بلغت سن الخامسة والستين قبل بدء أحداث العنف في لبنان في عام 1975، والمجموعة الثانية بلغت سن الخامسة والستين في فترة أحداث العنف (1975-1990)، والمجموعة الثالثة بلغت سن الخامسة والستين بعد انقضاء أحداث العنف (بعد عام 1990).

**الموجودات:** تضمّنت الدراسة 1037 بلاغاً عن الوالدين، مما جعلت معدلات

الوفيات الإجمالية 7.48 لكل ألف شخص - سنة (4.51 بين الآباء و3.45 بين الأمهات). وبالمقارنة مع مجموعة الأتراب الذين بلغوا سن الخامسة والستين قبل عام 1975، فإن مجموعة الأتراب الذين بلغوا سن الخامسة والستين خلال الفترة 1975-1990، كان لديهم أعلى اختطار للوفيات لدى الآباء (نسبة المعدل 48.1، وبفاصلة ثقة 95%، إذ تراوحت نسبة المعدل بين 07.1 و04.2)، ولدى الأمهات (نسبة المعدل 22.1، وبفاصلة ثقة 95%، إذ تراوحت نسبة المعدل بين 95.0 و58.1). وكان اختطار الوفيات أعلى بمقدار يُعتد به إحصائياً لدى الآباء منه لدى الأمهات، وهو تفاضل يتركز على الجنس، وكان في أعلى مقدار له لدى المجموعة التي بلغت سن الخامسة والستين في الفترة بين 1975 و1990.

**الاستنتاج:** تُعدّ هذه الدراسة الأولى من بين الدراسات المُركزة على السكان للتعرف على كمية أُمّاط الوفيات لدى مجموعات الأتراب المسنين المتزوجين. وتشير الموجودات والنتائج إلى أن أعمال العنف قد ساهمت في إنقاص البقاء على قيد الحياة، ولاسيما لدى الآباء. ويمثّل الأسلوب الذي أُتبِع في الدراسة اختياراً يمكن التطبيق لدراسة المسوحات الكبيرة وتعداد السكان في بلدان تفتقد بنى إحصائية أساسية موثوقة.

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