Marital status, intergenerational co-residence and cardiovascular and all-cause mortality among middle-aged and older men and women during wartime in Beirut: gains and liabilities

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Abstract

Studies from the West have shown an increased risk of mortality with various indicators of social isolation. In this study, we examine associations of marital status and intergenerational coresidence with mortality in Lebanon, a country that suffered wars and atrocities for almost 16 years. Using data from a retrospective 10-year follow-up study (1984-94) among 1,567 adults aged 50 years and older in Beirut, cardiovascular disease and all-cause mortality rates (per 1,000 person-years) were computed for men and women separately. Age-adjusted Mantel-Haenszel rate ratios (RR) and their 95% confidence intervals (CI) were estimated, and associations were examined using multivariate Poisson regression analysis. Most men (91.3%) were married at baseline, in contrast to only 55.4% of women. Compared to men, women were more likely to be living in one- and three-generation households and with a married child at baseline. While widowhood was associated with an increased risk of all-cause mortality among men only, being never married was associated with a higher CVD mortality risk among men and women. The presence of an adult married child was associated with a significantly higher mortality risk for men (RR=1.70, 95% CI: 1.19–2.43) and women (RR=1.55 95% CI: 1.04–2.32), even after adjusting for household socioeconomic indicators, marital status, lifestyle variables or pre-existing health-related conditions (hypertension, cholesterol, and diabetes) at baseline.

The popular belief that coresidence with adult children reflects greater support networks and an avenue for old age security may not be a valid presumption in the Lebanese context during times of war.

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Marital status, intergenerational coresidence and mortality among middle-aged and older men and women during wartime in Beirut: gains and liabilities

The relation of social factors to cardiovascular disease (CVD) morbidity and mortality has been the focus of epidemiological studies in the developed world for many decades. Only recently have these relations been examined in developing countries. In these studies, a diverse range of indicators, analyzed separately or as a composite index, have been used to measure social support and social networks. These include, among others, marital status, number of living children, coresidence, proximity to living children, social participation, and contacts with close relatives and friends.

Studies examining the association between marital status and mortality have documented higher risks in middle-aged and older unmarried individuals, especially men, than their married counterparts (Ebrahim, Wannamethee, McCallum, Walker, & Shaper, 1995; Hu & Goldman, 1990; Lund, Due, Modvig, Holstein, Damsgaard & Andersen, 2002; Lund, Holstein, & Osler, 2004; Malyutina, Bobak, Simonova, Gafarov, Nikitin & Marmot, 2004; Martikainen, Martelin, Nihtila, Majamaa & Koskinen, 2005; Rutledge, Matthews, Lui, Stone, & Cauley, 2003). For indicators of support other than marital status, Berkman and Syme's 9-year follow-up study in Alameda County, California, in 1965 showed initial evidence of their link with mortality (Berkam & Syme, 1979). This research and the reviews by Cassel (1976) and Cobb (1976) in the mid 70's spurred an increase in research on social ties and health. Each investigation tapped a different dimension of the relationship, with

relative risks of total mortality associated with less social network ranging between 2 to 4.0 (Kawachi, Colditz, Ascherio, Rimm, & Giovannucci, et. al. 1996).

Living arrangements may be an important mechanism by which social networks influence health and survival in later life because one's living arrangements are associated with the frequency and types of social support exchanged. In Bangladesh, for example, being the household head has been associated with a lower risk of mortality for men in one study (Mostafa & Van Ginneken, 2000), and for men and women in another; yet, this association declined with age (Rahman, 1999a). Also in Bangladesh, intergenerational coresidence with an adult son or daughter has been associated with a lower risk of mortality for women (Rahman, 1999b & 2000).

In many Middle Eastern countries, including Lebanon, social networks are widespread, and local norms regarding familial ties and social networks differ from the West. Therefore, it is unclear whether findings from one setting are applicable to another. Moreover, because of the lack of old age pension plans and social services in Lebanon (Sibai, Sen, Baydoun, & Saxena, 2004), the nature and extent of social ties is especially important for older adults. This situation is compounded by several waves of migration of young male workers, which resulted from years of civil unrest and war during 1975–1991. Earlier research on the association of living arrangements with mortality in later life has not disaggregated the effects of coresidence with married versus unmarried children. Yet, in lower income countries, this distinction may be important because married children often are important

sources of economic security for their older parents. Here, we examine the relationship between marital status and intergenerational living arrangements with CVD and total mortality in a 10-year retrospective follow-up study of middle-aged and older men and women within the Lebanese context during wartime.

Materials and methods

Study population

A cohort of 1,786 subjects (896 men and 890 women) aged 50 years or older was interviewed in 1984, as part of a population-based multi-dimensional health survey conducted by the Faculty of Health Sciences of the American University of Beirut. The sample for the 1984 survey was obtained proportional to household density using a cluster sampling design based on the geographical division of the city into zones and sectors. An adult resident informant provided the following data on household members: socio-demographic characteristics, behavioral risk factors, co-morbidity, and the use of health services. Details on the study design and fieldwork are described elsewhere (Zurayk & Armenian, 1985). The follow-up study conducted in 1993-94 traced households that had included in 1984 at least one individual aged 50 years or older.

Mortality outcomes

Data on vital status and cause of death were obtained for 1,567 subjects (87.7%) of the 1984 cohort. For those who had died between the baseline and follow-up surveys, a 'verbal autopsy' questionnaire was administered to a close relative who had lived with the deceased and/or was

the deceased's main caregiver in the year before death. The interview-schedule included details on the year and age at death, circumstances of the death including symptoms, signs, and complaints suffered by the deceased around the time of death, a checklist of co-morbid conditions, age at onset of each condition, and contacts with health services and injuries occurring during the year prior to death. The majority of verbal autopsies (80%) were conducted with a relative or a caregiver who had lived with the subject in the same household in the year preceding the death. In another 12% of the cases, the informant had lived either in the same building or within a few blocks from the house of the deceased. Data collection took place from June 1994 until August 1994. A physician who was not involved in the present study coded the underlying cause of death according to the *International Classification of Diseases,* Ninth Revision (ICD-9).

Attempts at assessing the validity of causes of death based on physician review of the verbal autopsies were hampered by a lack of other routine data sources for mortality during this unstable period in Lebanon's history. Hospital records were inaccessible, incomplete, or missing. Similarly, information on causes of death from the vital registration system was essentially non-existent. A re-search exercise conducted at the Vital Registration Department revealed a considerable proportion of death certificates with missing information on cause of death (66 percent and 57 percent for the years 1984 and 1994, respectively) and 'old-age and ill-defined conditions' constituted a further 5% of all registered deaths (Sibai, Nuwayhid, Beydoun, & Chaaya, 2002). Countries that lack reliable sources of data on mortality increasingly are adopting lay reporting schemes for the ascertainment of

cause-of-death. Verbal autopsies have been used in South Africa (Tollman, Kahn, Garenne & Gear, 1999), India (Kakrani, Pratinidhi & Gupte, 1996) and more recently in Jordan (Khoury, Massad & Fardous 1999) to assign causes of death in adulthood. In comparison to the gold standard (death certificates and hospital records), physician review of verbal autopsies had a high diagnostic accuracy for CVD (cause-specific mortality fraction within 10-19% of the true value) and neoplasms (<10%) in a sample of 796 adult deaths in Tanzania, Ethiopia, and Ghana (Quigley, Chandramohan & Rodrigues, 1999). Further details on the conduct of the follow-up study, mortality outcomes, and the validity and reliability of the verbal autopsy utilized in this study have been published elsewhere (Sibai, Fletcher, Hills & Campbell, 2001; Sibai, Fletcher & Armenian, 2001).

Variables and measures

One measure of marital status and two measures of intergenerational coresidence, all of which were assessed at baseline, were the main predictor variables in our analysis. Marital status was initially recorded as single (never married), married, widowed, separated, and divorced; yet, because few respondents reported being divorced or separated in 1984, these were merged with those who reported to be widowed. The first measure of intergenerational coresidence considered was the number of generations (one, two, and three or more) residing with the index older adult in 1984, with the last category including 10 subjects who were living in a four-generation household. Those who were living alone (n = 43) were considered as living in a one-generation household. The second measure was coresidence with specific types of relatives. Coresidence with an adult child has been a central feature of the familial

support system for older adults in most non-Western countries, and we hypothesized that the well being of the older adult would be further enhanced, through improved access to instrumental and emotional support, if this child were married. Consequently, subjects were classified according to the presence and martial status of the coresiding child, into five distinct and mutually exclusive groups: those living with 1) unmarried children only, 2) married children only, 3) married and unmarried children, 4) non-children others, and 5) alone. The majority of subjects (61.3%) were living with unmarried children, and only 19.1% were living with at least one married child (with or without unmarried children).

Baseline indicators of socio-economic status and established risk factors for CVD were included in this analysis as potential confounders. Whilst higher individual educational attainment often is associated with lower mortality, recent evidence supports the attenuation of the association at older ages (Liang, Bennett, Krause, Kabayashi, Kim et. al, 2002; Ross & Chia-ling, 1996). Given the older age distribution of our study cohort as well as the low percentage of working women (7%), measures for socio-economic status at the household level are preferable markers for standard of living and material resources than are the traditional, individual-level indices of SES. Accordingly, educational attainment of the head of household (primary level or above vs. less), economic activity of the head of household (economically active versus otherwise), and an index for crowding (less than one person per room, 1–1.9 per room, 2–2.9 per room, ≥3 per room) were considered in the analysis. Commonly-accepted risk factors for CVD morbidity and mortality included smoking status (never, ex- and current), alcohol consumption (never, ex- and current) and selected co-

morbid conditions. The latter were assessed at baseline by questions about whether a doctor had ever told the study subject that they had hypertension, diabetes, or hypercholesterolemia.

Statistical analysis

Frequency distributions of marital status and intergenerational coresidence as well as baseline covariates (household socio-economic status and reports of risk behaviors and chronic conditions) were evaluated for men and women separately, and differences by gender were examined using chi-squared (χ^2) tests of association. Age- and sex-specific CVD and all-cause mortality rates per 1,000 person years were estimated by dividing the number of respective events over total observation time (person-year) for each subject, with the latter being calculated from age 50 years until censoring. Censoring was defined as either change in the age stratum or the end of the study period, which ever occurred first. Age-adjusted rate ratios (RR) and their respective 95% confidence intervals (CI) comparing each exposure with its referent category were estimated.

Multivariate models were estimated for women and men separately. For each outcome M_k (where k = 1 for CVD mortality and k = 2 for all-cause mortality), we first estimated a partially adjusted Poisson regression model that included one of the three social indicators S_l (where l = 1 for marital status, l = 2 for multi-generational household, and l = 3 for coresidence with a married child) and that controlled for the subject's age and established risk factors for mortality (denoted by the vector **R**). We estimated fully adjusted Poisson regression models for each outcome, which included the above covariates and the indicators

for household socio-economic status (denoted by the vector **E**). Because intergenerational coresidence (especially with a married child) is determined by marital status and the influence of intergenerational coresidence on mortality can be explained partly by marital status, marital status is added as a confounder in the models examining the association between intergenerational coresidence and mortality. A total of 12 fully-adjusted multivariate models were estimated, or 6 each for men and women separately, as summarized by the equation below:

$$\text{Poisson}(M_k) = \beta_1 S_l + \mathbf{R}^T\boldsymbol{\beta} + \mathbf{E}^T\boldsymbol{\beta} \qquad k=1,2;\ l = 1,2,3$$

The statistical software STATA release 8.0 for Windows was used for all analyses.

RESULTS

During the follow-up period of 10.5 years, men (n = 796) and women (n = 771) contributed 7,033 and 7,103 person-years of exposure, respectively. There were 416 deaths from all causes (237 men and 179 women) including 249 deaths from CVD causes (147 men and 102 women). Estimated all-cause mortality rates were 33.7 (95% CI 29.7–38.3) deaths per 1000 person-years for men and 25.2 (95% CI 21.8–29.2) deaths per 1000 person years for women. The respective figures for CVD mortality were 20.9 (95% CI 17.8–24.6) and 14.4 (95% CI 11.8–17.4) deaths per 1000 person years. The most important causes were non-communicable diseases, mainly circulatory diseases (n = 249 (60%); ICD-9 codes 390-459) and cancer (n = 62 (15%); codes 140-208). Around 6% of all deaths were caused by injuries, both intentional and unintentional. The mortality structure, overall, reflected a pattern

comparable to what is observed in industrialized countries such as the US, England, and Wales (Sibai, Fletcher, Hills, & Campbell, 2001).

Most men (91.3%) were married at baseline, in contrast to only 55.4% of women (Table 1). This difference is expected in Lebanon because men tend to marry younger women (by about 10 years) who out-survive them and to remarry upon widowhood and divorce more often than do women. As a result, a substantially higher percentage of women (37.0%) than men (5.2%) were widowed or divorced at baseline. Notably, however, a higher percentage of women (7.7%) than men (3.5%) also had never been married (p-value < 0.01 for difference in these two proportions). This gender difference in the rate of never marriage contradicts the experience of adults in the United States, where rates of never marriage by age 50 years have increased over time but have remained fairly similar for women and men (Kreider, 2005).[1] Such cross-cultural differences in rates of never marriage for women relative to men suggest that gendered motivations and/or opportunities for marriage may differ cross-culturally in ways that make prior findings about the effects of marital status on health in Western settings not universally applicable. Compared to men, women also more often lived in households with less favorable socio-economic characteristics, and were more likely to be living in one- or three-generation households, with a married child, or alone. These gender differences in living arrangements are consistent with those from other Middle Eastern settings such as Egypt (Yount, 2005), and suggest two points. First, social norms dictate that

[1] In 2001, the following percentages of women and men had never married: 3.3% among those 70 years or older; 4.1-4.3% among those 60–96 years; and 6.3-6.4% among those 50–59 years (Kreider, 2005).

widowed women live with married children (60% of women who were living with married children were widowed compared to 20% of men). Second, higher rates of never marriage (and therefore childlessness) among women may make women more likely than men to live alone in old age. In most industrialized countries, women also more often live alone than do men after age 64 years, but overall rates of living alone tend to be higher than in this sample (Kinsella and Velkoff, 2001). Around one quarter of the subjects recalled a physician diagnosis for hypertension, 12.6% for diabetes and 8.3% for hypercholesterolemia. Although no differences were apparent between men and women with respect to reported levels of diabetes and hyprecholesterolemia, hypertension was more often reported among women than men.

(Insert Table 1)

Table 2 shows mortality rates per 1000 person-years and age-adjusted rate ratios of CVD disease mortality and all-cause mortality by measures of social indicators, for men and women. Results show higher risks for CVD and all-cause mortality among the unmarried (single and widowed) compared to the married, and associations generally were stronger for men than for women. This difference was significant for single men having higher risk of CVD mortality and widowed men having higher risk of overall mortality. Men and women living in three or more generation households showed higher risks of CVD (RR = 1.45, 95% CI 1.02–2.07 and RR = 1.27, 95% CI 0.86–1.88, respectively) and all-cause mortality (RR = 1.39, 95% CI 1.04–1.85 and RR = 1.44, 95% CI 1.06–1.95, respectively) than did those

living in one- or two-generation households. Compared to those living with unmarried children, age-adjusted mortality rates were, overall, higher for older men and women who were living with any combination of married children. Additionally men who were living alone, albeit not significantly, were at higher risk of CVD mortality.

Because analyses showed that age-adjusted CVD and all-cause mortality rates did not differ for subjects living with married children only and those living with both married and unmarried children, and because our hypothesis centered around living with at least one married child, these two categories were combined and compared with all the remaining living arrangements (living with unmarried children, non-children others, and alone). Thus, the final categorization of this indicator was a dichotomous comparison of coresidence with or without any married children. Compared to their counterparts, men and women living with at least one married child had significantly higher age-adjusted CVD and all-cause mortality rates.

(Insert Table 2)

To examine the possibility of selection bias insofar as an older adult's living arrangement at baseline might be a marker or had been the result of poor prior health, levels of co-morbidity were compared between the two living arrangement groups (Table 3). Overall, men and women living with at least one married child were more likely to be older, to have less education, and to report more often doctor-diagnosed hypertension, physical impairments,

and at least one chronic condition than were those who were living in other arrangements. Controlling, however, for differences in the age distributions of different co-residential groups, which may inflate levels of co-morbidity among those living with a married child, no significant differences in baseline rates of co-morbidity were apparent between the two co-residential groups among men and women. Nevertheless, men and women with low educational level were three times more likely to be living with married children (with or without unmarried children) than their counterparts.

(Insert Table 3)

Finally, Table 4 shows results from the partially and fully adjusted regression models, with estimated relative risks for CVD mortality in the top panel and for all-cause mortality in the bottom one. The results of the age-adjusted models were not appreciably altered with the inclusion of a wide list of potential covariates. Most notably, single men and women, respectively, experienced 2.50 (95% CI 1.28–4.89) and 2.03 (95% CI 0.95–4.33) times higher risks of CVD mortality than did their married counterparts. Being widowed was associated with a higher risk of all-cause mortality only among men (fully-adjusted RR = 1.63, 95% CI 1.06–2.52). Coresidence with an adult married child was associated with a significantly higher risk of all-cause mortality for men and women (RR = 1.70, 95% CI 1.19–2.43 and RR = 1.55, 95% CI 1.04–2.32, respectively) and CVD mortality for men (RR = 1.63, 95% CI 1.03–2.57).

(Insert Table 4)

DISCUSSION

Marital status

Consistent with the results of previous epidemiological studies, this study demonstrates lower mortality rates among married than unmarried older adults in Beirut. Yet, the magnitude and significance of the association of marital status with mortality risk varied by cause of death and gender. The most salient findings are the relatively high adjusted risk of CVD mortality associated with being single (never-married) versus married among men and women, and the higher adjusted risk of all-cause mortality among widowed versus married men.

Findings from similar studies conducted in the West are mixed. Some (Ebrahim, et. al, 1995; Mendes de Leon, Appels, Otten, & Schouten, 1992; Johnson, Backlund, Sorlie, & Loveless, 2000) but not all (Koskenvuo, Kaprio, Kesäniemi, & Sarna, 1980; Ben-Shlomo, Davey Smith, Shipley, & Marmot. 1993; Goldman, & Hu, 1993) show a relationship between being single and CVD morbidity and mortality. Most of these studies, however, have shown consistent results by gender: whenever single men showed a higher risk of mortality so did women, and vice versa, a finding that our study corroborates. Similarly, findings from our data that widowhood carries greater all-cause mortality risk among men (adjusted RR = 1.62) but not among women is consistent with results from other studies showing greater health-related benefits of marriage among men than women (Berkman, et. al 1979; Schoenbach, Kaplan, Fredman, & Kleinbaum, 1986; Goldman, Korenman, & Weinstein, 1995; Wilkins, 2003).

Scholars have offered several explanations for differentials in the risk of mortality by marital status: an artifact of reporting errors, an artifact of selection bias whereby those who are healthier are more likely to marry and re-marry, and a causal relationship owing to the protective social and psychological characteristics of marriage (Ben-shlomo, et. al 1993; Davis, Neuhaus, Moritz, & Segal, 1992; Hemstrom, 1996). In our study, there is no reason to believe that subjects misreported their marital status at baseline. Nevertheless, marital status may have changed during the follow-up period. Given the older age distribution of our study population, it also is unlikely that the never-married and widowed (re-) married during the follow-up (Bumpass, Sweet, & Martin, 1990); however, those who were married at baseline may have become widowed during the follow-up period. Thus, if the reference group of married individuals included some who became widows between 1984 and 1994, observed associations between marital status and mortality may be under-estimated, and especially for women where rates of widowhood are higher in this age group.

Notably, the CVD mortality advantage that is observed among the married may be a result of residual confounding with other potential risk factors that were not measured at baseline. This mortality advantage also may reflect a long-term more favorable social environment among the married compared to their never-married peers. Marriage in Lebanon is greatly valued and is viewed as an essential life transition for men and women. Thus, those who never marry may experience greater social isolation than do their married peers. For older women especially, who were less likely to have been in the work force during adulthood than were men, marriage

also is an important source of economic stability. Hence, for women, being single may enhance the risk of social isolation, and of economic vulnerability as a result of reduced access to financial resources.

For widowhood, on the other hand, the finding of its adjusted association with all-cause mortality among men but not women may partly be attributed to differences in social roles following bereavement. In the only study that has examined widowhood and mortality in Lebanon, a higher risk of total mortality was observed among widowers than among widows (Armenian, Saadeh & Armenian, 1987). Upon widowhood, women often assume additional responsibilities for household management and financial matters, which is considered rewarding in this and other Middle Eastern settings (Yount, 2005, 2006). By contrast, for widowed men, assuming any housekeeping functions contradicts established gender roles and may indicate lower esteem. This fact is compounded by retirement and a subsequent decline in contact with work-related colleagues, who often are a central part of men's social networks (Bowling, 1991; Yount, 2005).

Intergenerational coresidence

Regarding intergenerational coresidence, our initial hypotheses were that living in a multi-generational household and coresidence with an adult married child would benefit older adults, by expanding their relational networks and their opportunities to exchange material and non-material resources with such children. Findings from this analysis, however, contradicted expectations, with subjects living in more than a two-generation household and

those living with an adult married child having higher risks of mortality than their counterparts. These risks remained robust even after controlling for marital status, pre-existing health conditions, crowding index, and other socioeconomic indicators.

Studies examining the relationship between social ties and mortality vary in their definition of the exposure and the outcome. To our knowledge, no prior study has examined the relation of coresidence with *married* children and the risk of mortality. Because of differences in the age composition of study populations and the variety of confounders adjusted for, comparisons of the findings here with those from other studies are difficult to make. Still, given a general pattern in the literature of decreased mortality risk with larger social networks (Kawachi, et. al., 1996; Rahman, Foster, & Menken, 1992; Rahman, 1999b; Kaplan, Salonen, Cohen, Brand, & Syme, et. al, 1988; Seeman, Berkman, Kohout, LaCroix, Glynn, et. al, 1993; House, Landis & Umberson, 1988), it is surprising that living with 'more' others in Lebanon was not protective during the years of war. Several explanations for this finding merit consideration.

First, the measures of intergenerational coresidence investigated here may not capture the quality of relationships between household members, nor all relevant aspects of social networks (Seeman, & Berkman, 1988; Hermalin 1997). While such limitations on the surface are valid, it is equally arguable that, during wartime in Beirut, people were fully preoccupied with securing food, water and shelter, to the extent that extra-household interactions were circumscribed. In addition, the extended psychological stressors of repeated

electrical and telephone outages, shortages of water, and risky commutes to work likely hampered collective norms and diminished people's reliance on extra-household support.

Second, living arrangements are dynamic and may have changed between baseline and follow-up, introducing some source of bias. Given the older ages of the study subjects, the most likely residential change would have been one in which a 'healthy' older person at baseline who was living with unmarried children (or in a two generation household) moved in with a married child (or into a 3-generation household) upon becoming sick. While this argument supports the notion that there are reciprocal effects of illness and living arrangements, the referent category (those living with unmarried children) would, with follow-up, tend to include more of the sick subjects, resulting in an attenuation of the effect measure, and, the observed RR would be biased towards the null hypothesis.

Third, and more plausibly, residence with a married child may simply have been a marker for an a priori illness that 1) motivated the older person's co-residential arrangement and 2) was the real, underlying cause for death. Given the implications of this type of selection for the interpretation of the results, two approaches were taken to investigate the possibility that older adults chose their baseline co-residential arrangements as a function of their unobserved a priori health status. First, final multivariate models adjusted for important co-morbidities. While this adjustment may not have controlled fully for the effects of a priori illness on changes in coresidence, estimated RRs for models that included and excluded baseline co-morbidities were comparable (changes in the magnitude of the RR of mortality

for older adults living and not living with a married child ranged between 2 and 10 per cent). Second, post hoc sensitivity analyses were conducted in which the final multivariate model was estimated using the sub-sample of older adults that excluded those who died during the first two years of follow-up. Arguably, older adults who died in these first two years may have had an a priori illness that motivated both residence with a married child and an early death during the follow-up. If coresidence is simply a marker for an underlying fatal illness, then the removal of this subgroup should mitigate any negative effects of coresidence with a married child on mortality. Notably, the coefficients for residence with a married child did not differ appreciably across these two models (results from this analysis are available upon request).

Extensive knowledge of the study setting also suggests that it would be equally reasonable to consider the possibility that this coresidence-mortality relationship reflects a real, underlying shortage of economic resources and low socioeconomic status. In this period in Lebanon's history (1975-1991), broader changes in economic conditions probably had dramatic effects on an older person's living arrangements. During the years of conflict, for example, many Lebanese suffered not only from the deaths of relatives, but also from galloping inflation and ensuing declines in standards of living. The real value of the minimum monthly wage, during the late 1980's, dropped from $120 to $15, and in May of 1986, approximately 40% of private-sector workers were unemployed. Furthermore, public social security and old-age pensions also have been lacking for a majority of the elderly in Lebanon (Sibai, Sen, Baydoun, & Saxena, 2004). Although the present study cannot answer

the question of who moved with whom and the reasons for coresidence, prevailing national economic conditions may have been an important force in decisions about coresidence.

This interpretation is consistent with another finding from this study that the less educated older adults were more likely to live with married children (Table 3). Given that less educated parents tend to have less educated children (Haveman & Wolfe, 1995), coresidence with a married child may suggest obstacles to the child's financial independence more than parental health-related need, especially in Middle Eastern settings where newly married children are expected to live separately (Yount, 2005). Studies elsewhere that were conducted in the 1990s have shown that intergenerational coresidence more often resulted from the children's economic need than their parents' declining health (Ward, Logan & Spitze, 1992; Aquilino, 1990). Among Malaysians aged 60 years and older, for example, a shared desire among children and parents to reduce their costs of living influenced coresidence, whereas wealthier parents used their higher income to 'purchase privacy' and to avoid the strains of intergenerational coresidence (Da Vanzo & Chan, 1994). Thus, the financial dependence of married children on their older parents during the civil war in Beirut may have been an added burden and stress to the older parents, with potentially negative implications for health and survival (Pearlin, Schieman, Fazio & Meersman, 2005).

While the results from both sensitivity analyses and the context of our study setting support the idea that living with a married child may have had real, adverse effects on older parents,

the possibility of residential selectivity on the basis of an unmeasured, underlying illness cannot be disregarded. According to Grundy (1992), the social and financial needs of adult children and their older parents should be considered when exploring the pathways to coresidence. Thus, the adverse impact on elderly mortality of living with married children in this study also may have derived from the fact that uneducated, poorer older adults were more likely than their better-off peers to have had an a priori illness, and thus to have been living with a married children at baseline. The potentially simultaneous effects on decisions about intergenerational coresidence of scarce economic opportunity among adult children and underlying ill-health among older adults cannot be ruled out.

Like most studies relying on secondary analysis, our study may have been limited by a dependence on self-reported indicators of baseline health conditions. Yet, household interview data in other populations have been shown to be reliable and valid for well-defined chronic conditions (Kehoe, Suh-Yuh, Leske & Chylack, 1994; Magaziner, Spear Bassett, Hebel & Gruber-Baldini, 1996). Similarly, in an earlier case-study from Beirut (Halabi, Zurayk, Awaida, Darwish & Saab, 1992), the percent agreement between reported responses and clinical examination was shown to be relatively high for salient conditions such as hypertension and heart diseases (Youden J index 0.63 and 0.80, respectively). While it is likely that hypercholesterolemia, being a non-salient condition, may have been limited by underreporting/misclassification biases, baseline indicators of health conditions, including diabetes, hypertension and hypercholesterolemia, were considered potential confounders, and misclassification of a confounding variable produces no bias to an effect

measure, unless its distribution in *each* exposure-mortality category is differentially misclassified (Marshall, 1994). Because of the cohort nature of the study, there is no reason to believe that respondents misclassified confounders differentially by living arrangements or by mortality outcome.

In spite of the above, this study provides evidence consistent with findings in the West that marriage is protective, especially for Lebanese men. Gender differences were found to be more evident in the case of widowhood and divorce. In Lebanese family households, the marital status of coresiding adult children also may have important implications for mortality in old age. The excess mortality risk found among those living with an adult married child or in multi-generational households may reflect the compounding effects of underlying illnesses and the distress associated with economic hardships that families face during times of war. Whether similar results would be observed today (during a time of peace) or in other settings in the region is a worthy question for future research.

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TABLE 1 Baseline marital status, intergenerational coresidence and selected socio-demographic and health-related characteristics of a cohort of older adult men and women (aged 50 years and over), Beirut, Lebanon

Variables	Total (n = 1567)		Men (n = 796)		Women (n = 771)		
	no.	%	no.	%	no.	%	p-value
Age (years)							
50-59	846	53.9	427	53.6	419	54.4	0.512
60-69	417	26.6	222	27.9	195	25.3	
70-79	211	13.5	105	13.2	106	13.8	
80+	93	6.0	42	5.3	51	6.6	
Mean ± standard deviation	61.0 ± 9.5		60.9 ± 9.2		61.1 ± 9.7		0.690
Marital status							
Married	1154	73.6	727	91.3	427	55.4	<0.001
Single	87	5.6	28	3.5	59	7.7	
Widowed/divorced	326	20.8	41	5.2	285	37.0	
Number of generations							
One generation	222	14.2	89	11.2	133	17.2	<0.001
Two generations	953	60.8	550	69.1	403	52.3	
Three or more	392	25.0	157	19.7	235	30.5	
Intergenerational coresidence							
Living with unmarried children only	960	61.3	569	71.5	391	50.7	<0.001
Living with non-children others	265	16.9	117	14.7	148	19.2	
Living alone	43	2.7	3	0.4	40	5.2	
Living with married children only	188	12.0	55	6.9	133	17.3	
Living with married and unmarried children	111	7.1	52	6.5	59	7.7	
Household socio-economic indicators							
Education of head							
None/Less than primary	545	35.0	260	32.8	285	37.2	0.073
Primary and above	1014	65.0	532	67.2	482	62.8	
Activity status of head							
Economically active	930	59.4	543	68.2	387	50.3	<0.001
Retired/ housewife	635	40.6	253	31.8	382	49.7	
Crowding index (person/room)							
Less than one	535	34.1	243	30.5	292	37.9	0.020
1-1.9	682	43.5	364	45.7	318	41.2	
2-2.9	219	14.0	121	15.2	98	12.7	
3 or more	131	8.4	68	8.6	63	8.2	
Health-related variables							
Smoking (% current)	537	34.3	353	44.4	184	23.9	<0.001
Alcohol (% current)	360	23.0	252	31.7	108	14.0	<0.001
Recall of a doctor's diagnosis of							
Hypertension (% yes)	397	25.3	157	19.7	240	31.1	<0.001
Diabetes (% yes)	197	12.6	91	11.4	106	13.7	0.167
Hypercholesterolemia (% yes)	130	8.3	61	7.7	69	8.9	0.356

TABLE 2 Associations of marital status and intergenerational coresidence at baseline with mortality: number of events, rates per 1000 person-years, age-adjusted rate ratios and their 95% confidence intervals (CI) for men and women, Beirut

	Cardiovascular disease mortality								All-cause mortality							
	Men				Women				Men				Women			
	No.	Rate†	RR†	95% CI	No.	Rate†	RR†	95% CI	No.	Rate†	RR†	95% CI	No.	Rate†	RR†	95% CI
Marital status																
Married	121	18.6	1.0		30	7.2	1.0		200	30.7	1.0		61	14.6	1.0	
Single	10	40.2	2.09*	1.10–3.99	11	19.6	1.57	0.81–3.05	10	40.2	1.25	0.66–2.37	14	24.9	1.05	0.60–1.82
Widowed/divorced	16	57.6	1.42	0.80–2.53	61	25.7	1.47	0.94–2.30	27	97.1	1.62*	1.04–2.51	104	43.8	1.20	0.85–1.69
Number of generations																
One generation	25	32.6	1.00		15	12.2	1.00		33	43.0	1.0		29	23.6	1.0	
Two generations	77	15.4	0.82	0.52–1.31	39	10.0	1.22	0.66–2.27	135	26.9	1.05	0.71–1.55	61	15.7	0.92	0.58–1.45
Three or more	45	35.9	1.17	0.72–1.92	48	24.2	1.51	0.84–2.71	69	55.0	1.41	0.93–2.14	89	44.8	1.37	0.89–2.10
Three or more vs. two or less			1.45*	1.02–2.07			1.27	0.86–1.88			1.39*	1.04–1.85			1.44*	1.06–1.95
Intergenerational coresidence: living with																
Unmarried children only	78	15.0	1.00		32	8.5	1.00		135	26.0	1.00		58	15.4	1.00	
Non-children others	32	31.4	1.32	0.87-1.99	17	12.0	1.02	0.56-1.86	40	39.3	1.00	0.67-1.44	29	20.4	0.95	0.61-1.48
Living alone	2	69.0	1.66	0.40-6.94	7	20.4	1.01	0.43-2.42	2	69.0	1.13	0.27-4.65	11	32.1	0.86	0.44-1.69
Married children only	22	62.0	1.60	0.99-2.60	36	34.2	1.43	0.86-2.38	41	115.5	2.01*	1.38-2.94	62	58.9	1.29	0.88-1.89
Married & unmarried children	13	29.4	1.62	0.89-2.93	10	19.3	1.73	0.86-3.50	19	43.0	1.37	0.85-2.23	19	36.7	1.81*	1.08-3.03
Unmarried children/others‡	112	18.0	1.00		56	10.1	1.00		177	27.4	1.0		98	17.7	1.00	
Married children	35	43.9	1.53*	1.05–2.24	46	29.3	1.52*	1.04–2.54	60	75.3	1.76*	1.30–2.37	81	51.6	1.51*	1.11–2.04

* p-value < 0.05

† Rate per 1000 person years, rate ratios adjusted for age.

‡ Unmarried children/others included the first three arrangements (unmarried children only, nonchildren others, and those living alone) and the married child category included the latter two categories (married children with or without unmarried children)

TABLE 3 Baseline associations of socio-demographic and health-related characteristics with coresidence with a married child among men and women in 1983, Beirut

	Men				Women			
	Coresidence with				Coresidence with			
Status in 1983	Unmarried child/others N=689 %	At least one married child N=107 %	OR	*p*-value*	Unmarried child/others N=579 %	At least one married child N=192 %	OR	*p*-value*
Mean age ± SD†	59.9± 0.33	67.3± 1.0		<0.001	59.2± 0.35	66.8± 0.8		<0.001
Educational level (% low)	32.5	61.9	3.00	<0.001	47.6	74.7	3.02	<0.001
Health-related variables								
Hypertension (% yes)	18.4	28.0	1.29	0.309	29.0	37.5	1.13	0.520
Diabetes (% yes)	11.8	9.4	0.63	0.200	13.0	16.2	1.17	0.518
Hypercholesterolemia (% yes)	8.0	5.6	0.65	0.364	9.6	7.3	0.76	0.420
Impairments (% yes)	2.6	4.7	1.27	0.667	2.1	4.2	0.81	0.661
Number of chronic diseases								
None	46.0	33.6			31.6	22.9		
One	26.9	34.6	1.27	0.374	31.1	33.9	1.53	0.076
Two-three	23.5	24.3	1.12	0.689	29.9	34.4	1.30	0.275
Four or more	3.6	7.5	1.26	0.679	7.4	8.9	1.14	0.701

* *P*-values based on Mantel-Haenszel age-adjusted odds ratios
† Standard deviation

TABLE 4 Partially and fully-adjusted rate ratios and their 95% confidence intervals (CI) for cardiovascular and all-cause mortality by marital status and living arrangements among men and women, Beirut

Exposure (referent category)	Men				Women			
	Partially adjusted†		Fully adjusted ‡		Partially adjusted†		Fully adjusted ‡	
	RR	95% CI	RR	95% CI	RR	95% CI	RR	95% CI
Cardiovascular disease mortality								
Marital status (married)								
Single	2.34*	1.21–4.50	2.50*	1.28–4.89	2.08*	1.02–4.26	2.03	0.95–4.33
Widowed/divorced	1.29	0.74–2.25	1.40	0.80–2.46	1.52	0.94–2.46	1.53	0.95–2.48
Number of generations (one or two)								
Three or more generations	1.52*	1.05–2.20	1.99*	1.32–3.00	1.16	0.77–1.74	1.32	0.78–2.25
Coresidence (with unmarried child/others)								
With a married child	1.32	0.87–2.00	1.63*	1.03–2.57	1.40	0.92–2.13	1.61	0.93–2.78
All-cause mortality								
Marital status (married)								
Single	1.43	0.75–2.71	1.59	0.83–3.03	1.24	0.69–2.26	1.24	0.67–2.33
Widowed/divorced/separated	1.51	0.99–2.33	1.63*	1.06–2.52	1.25	0.88–1.77	1.25	0.88–1.79
Number of generations (one or two)								
Three or more generations	1.41*	1.05–1.89	1.56*	1.12–2.15	1.31	0.96–1.79	1.43	0.97–2.10
Coresidence (with unmarried child/others)								
With a married child	1.58*	1.14–2.17	1.70*	1.19–2.43	1.43*	1.04–1.97	1.55*	1.04–2.32

* p-value < 0.05.

† Controlling for age, cigarette smoking, alcohol use, hypertension, hypercholesterolemia, and diabetes.

‡ Controlling additionally for education and activity status of head of household and crowding index. In the case of number of generations and coresidence with a married child, the model included marital status as well.