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Does one's own and one's spouse's education affect overall and cause-specific mortality in the elderly?

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Objectives To examine educational gradients in overall and cause-specific mortality among elderly married men and women and their spouses.

Methods Using the census-based Israel Longitudinal Mortality Study (1983–92), 13 573 married men and 6563 married women were identified who were aged 70–89 years at baseline. Cox proportional hazard models were used to assess the strength of the association between education and overall and cause-specific mortality.

Results Educational gradients for own and spouse's mortality varied by gender and cause of death. In particular, in relation to cardiovascular disease, men married to uneducated wives experienced elevated mortality risks [hazard ratio (HR) = 1.30; 95% confidence interval (95% CI) 1.11–1.52]. Women were generally unaffected by their husband's education, except for those who died from non-breast cancer, for whom husband's low education had a harmful effect (HR = 1.98; 95% CI 1.26–3.11).

Conclusions Mortality among elderly married persons is associated with one's own and one's spouse's educational achievement. Research using partner's education as a proxy for one's own attainment may be omitting valuable information regarding these and other health risks.

Keywords Cancer, cardiovascular disease, education, elderly, mortality, spouse

In developed countries, persons ⩾70 years of age constitute ~10% of the population and over the next 25 years a dramatic increase in size and proportion of elderly in the population is expected.[1] In the United States, for example, there are currently ~24 million people between the ages of 70 and 89 years with a projected increase to ~40 million by the year 2025.[1] The health of this elderly population depends on an array of factors, including reducing chronic disabilities, improving health care management and treatment, and minimizing risky behaviours.[2]

Recently, a number of studies have examined 'successful aging' using demographic and socioeconomic variables for both men and women.[3–6] Much of this research indicates that socioeconomic gradients persist into older age for overall and cause-specific mortality.[3,5] Few studies, however, have looked at predictors of health among older married couples,[7] and, to the best of our knowledge, none have examined the contribution of a spouse's characteristics to one's risk of dying.

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In the present study, we use the national Israel Longitudinal Mortality Study to determine whether the educational levels of married men and women aged 70–89 years affect their own and their spouse's overall and cause-specific mortality. In particular, we address the following questions: (i) do overall and cause-specific mortality differentials by educational attainment exist among elderly married men and women and (ii) what effect does a spouse's educational attainment have on overall and cause-specific mortality?

Methods

Data

The Israel Longitudinal Mortality Study links census records from a 20% systematic sample of households in the 1983 census, with records of death occurring in the subsequent 9.5 years, i.e. until the end of 1992.[8] Israel has a population register in which a unique number identifies every resident—newborn or immigrant. The record linkage was performed by the Israel Central Bureau of Statistics by means of this unique identification number that appeared in both the census records and death

notifications. Prior to analysis, all personal identifiers were deleted from the dataset to remove the possibility of identification. The quality of the linked dataset was enhanced by the near-complete coverage in the 1983 census wherein only 2.6% of the population evaded enumeration, and by the fact that practically all deaths in Israel are recorded. The linkage was verified by comparing six demographic variables available in both data sources. Methodological details have been described elsewhere.[8]

Demographic and socioeconomic variables were measured at the time of the census. Date and cause of death for those who died during the follow-up period were ascertained from death certificates. Excluded from the study were institutionalized persons and those living in kibbutzim (collective agricultural communities). Married individuals were identified from heterosexual monogamous marriages at the time of the census, where the husband or wife was the documented head of the household. We chose to focus this analysis on an elderly and not middle-aged population as cause of death and the influential pathways of education vary between these age groups.[9–11] Included in the study were 13 573 married men and 6563 married women between the ages of 70–89 years in 1983, with spouses ages ⩾40 years. (The discrepancy in the numbers of men and women stem from the age differentials in marriages, whereby a large proportion of men are married to women <70 years old.) For ~90% of these couples, this was their first marriage. During the follow-up period 7220 (53.2%) men and 2676 (40.8%) women died.

Variables

Dependent variables

Outcome measures were overall and cause-specific mortality that occurred during the 9.5 year follow-up period. Cause-specific mortality was determined using the International Classification of Disease codes consistent with the 9th revision (ICD-9). Four major causes of death were studied: cardiovascular disease (CVD) (390–459) (hypertensive diseases = 401–405; ischaemic heart diseases = 410–414; cerebrovascular diseases = 430–438), cancer (140–209) (breast cancer = 174; prostate cancer = 185), respiratory disease (480–519), and other causes (Table 1).

Table 1 Distribution of cause-specific deaths for men and women aged 70–89 years, the Israel Longitudinal Mortality Study, 1983–92

Cause of death	Men No. (%)	Women No. (%)
Cardiovascular diseases (390–459)	3555 (49.2)	1409 (52.7)
Hypertensive diseases (401–405)	65	50
Ischaemic heart diseases (410–414)	1847	659
Cerebrovascular diseases (430–438)	600	270
Other cardiovascular diseases	1043	430
All cancers (140–209)	1283 (17.8)	436 (16.3)
Upper digestive tract (140–150)	37	6
Stomach (151)	127	24
Colon and rectum (152–154)	186	81
Liver (155)	18	8
Pancreas (157)	85	22
Lung (162)	207	32
Melanoma (172)	13	2
Breast (174)	–	85
Uterus and ovary (179–183)	–	31
Prostate (185)	177	–
Bladder and kidney (188–189)	102	17
Lymphoma and leukaemia (200–208)	112	44
Other cancers	219	84
Respiratory diseases (460–519)	605 (8.4)	177 (6.6)
Other diseases	1777 (24.6)	654 (24.4)
Infectious and parasitic diseases (001–139)	151	53
Endocrine, nutritional, and metabolic diseases (240–279)	164	75
Neurological diseases (290–389)	271	109
Digestive diseases (520–579)	190	77
Genitourinary diseases (580–599)	339	114
Injury or poisoning (800–999)	236	78
Other	426	148
Overall	7220 (100)	2676 (100)

Explanatory variables

Age was coded by 5-year intervals. For origin, individuals were classified according to continent of birth: 'North Africa', 'Asia', and 'Europe ', unless born in Israel in which case origin was based on father's country of birth. Included in 'Europe' were a small proportion of persons (2.8%) originally from North America, South America, and Australia. Education was defined as number of years of school attended grouped into four categories: 0–4, 5–8, 9–12, or ⩾13 years.

Statistical analyses

The association between education and overall and cause-specific mortality was assessed using Cox proportional hazard models. Data were analysed in two stages: first examining the educational level of each spouse separately, then in a model with both husband's and wife's education. An interaction term for both spouses' education was then introduced into the model; however, the interaction term was non-significant in all models and, therefore, not presented. Notably, our dataset yields considerable power to detect main effects. For example, comparing women in the two extreme educational categories, we have 90% power to detect a relative risk of at least 1.2 and 1.3 for overall and cardiovascular mortality, respectively. This power is substantially reduced for detecting interactive effects. Models presented here included age and origin.[12] We reanalysed the data adjusting for spouse's age and found similar estimates for the effect of education on mortality. Deaths from breast and non-breast cancers were analysed separately, since an increased incidence of breast cancer has been found to be associated with higher levels of education.[13] Sub-analyses of the major cancers in men (i.e. colon and rectum, lung, and prostate) showed similar results as for all cancers except for prostate cancer, and results are presented separately. Models for CVD mortality were examined by the main subcategories namely ischaemic heart disease and cerebrovascular disease yielding similar trends (data not shown).

We assessed the influence of collinearity between spouses' education (men = 0.61; women = 0.62) using an

adaptation of the standard inflation factors method for Cox proportional hazard models[14] and found that our results were not affected.

Results

The influence of education on mortality was assessed for married men and women, aged 70–89 years (Table 2). Regarding educational attainment, over half of the study sample had <8 years of schooling and approximately one-third had 9–12 years. Highly educated individuals, with ⩾13 years of education, represented ~16 and 10% of men and women, respectively.

Table 3 presents hazard ratios for all-cause and cause-specific mortality for men by their own education (Model 1), spouse's education (Model 2), and both own and spouse's education (Model 3), adjusted for age and origin. Less-educated men had higher risks of death from all causes, CVD, non-prostate cancer and respiratory diseases, compared with men with more years of education (Table 3; Model 1). For example, men with 0–4 years of education had a 77% greater likelihood of dying from respiratory disease (HR = 1.77; 95% CI 1.30–2.41) relative to men with ⩾13 years of education. Contrary to these findings, lower educational attainment was protective against death from prostate cancer such that men with 0–4 years of education were 58% less likely to die (HR = 0.42; 95% CI 0.25–0.71) than men with ⩾13 years of education.

The influence of a wife's educational attainment on her husband's mortality was examined in Model 2 (Table 3). A wife's educational attainment had a somewhat greater influence on her husband's risk of all-cause, CVD, and non-prostate cancer mortality than his own educational attainment. For deaths from prostate cancer and respiratory diseases, the risks associated with wife's education mirrored that of her husband's, as seen in Model 1.

In Model 3 (Table 3) we examined the joint effect of both spouses' education on the husband's mortality risk and found that a wife's lower education attenuated the effect of her husband's education and was associated with her husband's excess all-cause and CVD mortality. The deleterious effect of one's own or one's spouse's low education on non-prostate cancer was lessened and became non-significant in this model incorporating both spouses' education. For respiratory disease, excess mortality risks were attributed to one's own and not one's wife's education.

The effect of own and spouse's education on women's mortality is presented in Table 4. We observed that married women with 0–4 years of education were 39% (HR = 1.39; 95% CI 1.19–1.63) more likely to die of all causes than women with ⩾13 years of education (Model 1). These findings reflected the hazard ratios for deaths from CVD, non-breast cancers and respiratory diseases, although, for the latter two causes of death the differences were not significant. No association was found between education and breast cancer mortality even in models comparing 0–12 years vs ⩾13 years of education (data not shown).

A husband's education affected his wife's mortality in a similar manner as her own education for all causes except non-breast cancer mortality (Model 2; Table 4). For non-breast cancer mortality, women married to men with 0–4 years vs those with ⩾13 years of education exhibited an increased risk of death (HR = 1.62; 95% CI 1.10–2.37).

The additional influence of a husband's education on his wife's overall mortality was modest relative to her own education-related risks (Table 4; Model 3). However, in the case of non-breast cancers, husbands with low education (0–4 years) compared with those with ⩾13 years of education increased their wives' mortality risk by ~2-fold (HR = 1.98; 95% CI 1.26–3.11).

Table 2 Characteristics of married men and women, aged 70–89 years, the Israel Longitudinal Mortality Study, 1983–92

	Men (n = 13 573)	Women (n = 6563)
Age, years, mean (SD)	75.1 (4.3)	73.9 (3.5)
Spouse's age, years, mean (SD)	68.0 (6.7)	76.4 (5.6)
Origin (%)		
Europe	74.5	81.1
Africa	9.5	6.6
Asia	16.0	12.2
Spouse's origin (%)		
Europe	74.0	81.1
Africa	10.1	6.4
Asia	15.9	12.5
Education (years)		
13+	16.4	9.5
9–12	29.4	30.6
5–8	33.5	34.7
0–4	20.7	25.2
Spouse's education (years)		
13+	9.5	16.3
9–12	32.1	29.7
5–8	33.7	33.7
0–4	24.7	20.3
No. died during follow-up	7220	2676

Discussion

We found mortality differentials by educational attainment among elderly married men and women. Specifically, individuals with 0–4 years of education were more likely to die from all causes, from cardiovascular and respiratory diseases, and from many cancers, than those with ⩾13 years of education after adjusting for age and origin. This was most strongly evidenced among men and respiratory disease mortality such that those with low compared with high education had a 2-fold increased mortality risk. Interestingly, a protective effect of low education was observed for deaths from prostate cancers in that relative to men with ⩾13 years of education, those with 0–4 years of education were 58% less likely to have died during the follow-up period. Next, we examined the contribution of a spouse's education to one's own mortality with varied results by gender and cause of death. In particular, in relation to CVD mortality, men benefitted from being married to educated wives, whereas women, excluding those who died from cancer, were unaffected

Table 3 Hazard ratios (HRs) and 95% confidence intervals (95 CIs) of the association between own and spouse's education and mortality, men aged 70–89 years, the Israel Longitudinal Mortality Study, 1983–92[a]

	Model 1[b]		Model 2[b]		Model 3[b]	
	HR	(95% CI)	HR	(95% CI)	HR	(95% CI)
Overall (no. died = 7220)						
Own education (years)						
13+	1.0				1.0	
9–12	1.06	(0.99–1.14)			1.03	(0.95–1.11)
5–8	1.09	(1.01–1.17)			1.02	(0.95–1.11)
0–4	1.20	(1.11–1.30)			1.09	(0.99–1.20)
Spouse's education (years)						
13+			1.0		1.0	
9–12			1.15	(1.05–1.25)	1.14	(1.04–1.25)
5–8			1.20	(1.09–1.30)	1.18	(1.07–1.29)
0–4			1.34	(1.21–1.47)	1.28	(1.14–1.43)
Cardiovascular diseases (no. died = 3555)						
Own education (years)						
13+	1.0				1.0	
9–12	1.06	(0.95–1.17)			1.02	(0.92–1.13)
5–8	1.13	(1.02–1.24)			1.06	(0.94–1.18)
0–4	1.19	(1.06–1.34)			1.07	(0.94–1.18)
Spouse's education (years)						
13+			1.0		1.0	
9–12			1.16	(1.02–1.31)	1.14	(1.01–1.30)
5–8			1.22	(1.08–1.38)	1.19	(1.04–1.36)
0–4			1.36	(1.18–1.56)	1.30	(1.11–1.52)
Cancer (non-prostate) (no. died = 1106)						
Own education (years)						
13+	1.0				1.0	
9–12	1.07	(0.90–1.29)			1.03	(0.86–1.24)
5–8	1.03	(0.86–1.23)			0.98	(0.80–1.19)
0–4	1.25	(1.02–1.53)			1.19	(0.93–1.51)
Spouse's education (years)						
13+			1.0		1.0	
9–12			1.21	(0.97–1.50)	1.20	(0.96–1.50)
5–8			1.19	(0.95–1.48)	1.19	(0.93–1.51)
0–4			1.32	(1.03–1.69)	1.20	(0.91–1.60)
Prostate Cancer (no. died = 177)						
Own education (years)						
13+	1.0				1.0	
9–12	0.73	(0.49–1.08)			0.72	(0.48–1.09)
5–8	0.56	(0.37–0.84)			0.57	(0.36–0.89)
0–4	0.42	(0.25–0.71)			0.41	(0.23–0.76)
Spouse's education (years)						
13+			1.0		1.0	
9–12			0.96	(0.59–1.57)	1.10	(0.55–2.15)
5–8			0.74	(0.44–1.23)	1.00	(0.57–1.74)
0–4			0.66	(0.36–1.20)	1.09	(0.66–1.82)
Respiratory diseases (no. died = 605)						
Own education (years)						
13+	1.0				1.0	
9–12	1.52	(1.13–2.05)			1.44	(1.06–1.87)
5–8	1.73	(1.30–2.31)			1.58	(1.16–2.16)
0–4	1.77	(1.30–2.41)			1.65	(1.17–2.34)
Spouse's education (years)						
13+			1.0		1.0	
9–12			1.46	(1.02–2.10)	1.29	(0.89–1.87)
5–8			1.70	(1.19–2.42)	1.38	(0.94–2.01)
0–4			1.67	(1.14–2.44)	1.29	(0.85–1.96)

[a] All models are adjusted for own age and origin.

[b] Model 1 = own education; Model 2 = spouse's education; Model 3 = own + spouse's education.

by their husband's education. Lastly, a husband's higher education protected his wife from non-breast cancer death; no such effect was observed for breast cancer mortality risk.

Own education and mortality

As in other studies,[3,9,10,12,15,16] lower educational attainment predicted higher all-cause, CVD, and respiratory mortality risks for elderly men and women. This inverse relationship can be attributed to the direct and/or indirect influences of education on various environmental exposures and health behaviours that accumulate over a life course and affect morbidity and mortality.[17–20]

In our analysis of CVD mortality, both men and women with decreased educational achievement exhibited greater risks of death. These findings are consistent with published reports in younger[17,21] and older age groups.[12,15] The observed inequalities in CVD mortality, whereby women's risks by education exceeded those of men, are also consistent with earlier reports.[22]

For respiratory-related mortality, there were marked educational gradients for men, while no significant association was apparent among women. This is supported by the strong associations between smoking and chronic obstructive pulmonary disease and socioeconomic position and by the fact that smoking is more prevalent among men of all ages.[19,23,24]

Much of the literature relating to socioeconomic status (SES) and cancer mortality is equivocal and often difficult to interpret since trends in incidence vary with temporal changes in carcinogen exposure, diagnosis, and screening, and by the age, ethnicity, and cultural makeup of the cohort.[16,25–27] Furthermore, among the elderly, co-morbidities often complicate the diagnosis, treatment, and management of cancer.[28,29]

In our study, we showed that low educated men are 25% more likely to die of non-prostate cancers and 58% less likely to die of prostate cancer than their more highly educated peers. The inverse relationship between SES and non-prostate cancer is

Table 4 HRs and 95% CIs of the association between own and spouse's education and mortality, women aged 70–89 years, the Israel Longitudinal Mortality Study, 1983–92[a]

	Model 1[b]		Model 2[b]		Model 3[b]	
	HR	(95% CI)	HR	(95% CI)	HR	(95% CI)
Overall (no. died = 2676)						
Own education						
13+	1.0				1.0	
9–12	1.07	(0.92–1.24)			1.04	(0.89–1.22)
5–8	1.28	(1.11–1.48)			1.23	(1.05–1.44)
0–4	1.39	(1.19–1.63)			1.27	(1.06–1.53)
Spouse's education						
13+			1.0		1.0	
9–12			1.11	(0.99–1.26)	1.07	(0.95–1.22)
5–8			1.19	(1.05–1.34)	1.07	(0.94–1.22)
0–4			1.35	(1.18–1.54)	1.18	(1.01–1.38)
Cardiovascular diseases (no. died = 1409)						
Own education						
13+	1.0				1.0	
9–12	1.09	(0.89–1.35)			1.05	(0.85–1.31)
5–8	1.37	(1.12–1.68)			1.27	(1.02–1.59)
0–4	1.50	(1.20–1.87)			1.37	(1.06–1.77)
Spouse's education						
13+			1.0		1.0	
9–12			1.15	(0.97–1.36)	1.10	(0.92–1.31)
5–8			1.32	(1.12–1.56)	1.17	(0.97–1.40)
0–4			1.39	(1.15–1.68)	1.16	(0.93–1.45)
Cancer (non-breast) (no. died = 351)						
Own education						
13+	1.0				1.0	
9–12	1.37	(0.92–2.02)			1.20	(0.80–1.79)
5–8	1.04	(0.70–1.55)			0.86	(0.56–1.32)
0–4	1.16	(0.74–1.80)			0.80	(0.48–1.33)
Spouse's education						
13+			1.0		1.0	
9–12			1.49	(1.06–2.09)	1.49	(1.05–2.11)
5–8			1.29	(0.91–1.81)	1.46	(1.00–2.13)
0–4			1.62	(1.10–2.37)	1.98	(1.26–3.11)
Breast Cancer (no. died = 85)						
Own education						
13+	1.0				1.0	
9–12	0.63	(0.31–1.30)			0.71	(0.33–1.51)
5–8	0.98	(0.50–1.92)			1.15	(0.54–2.45)
0–4	0.80	(0.35–1.79)			0.94	(0.36–2.49)
Spouse's education						
13+			1.0		1.0	
9–12			0.69	(0.38–1.27)	0.70	(0.37–1.32)
5–8			0.83	(0.46–1.47)	0.73	(0.37–1.41)
0–4			0.80	(0.39–1.63)	0.74	(0.31–1.78)
Respiratory (no. died = 177)						
Own education						
13+	1.0				1.0	
9–12	0.75	(0.41–1.36)			0.72	(0.39–1.35)
5–8	1.18	(0.67–2.07)			1.17	(0.63–1.35)
0–4	1.68	(0.93–3.05)			1.55	(0.77–3.10)
Spouse's education						
13+			1.0		1.0	
9–12			1.18	(0.72–1.94)	1.16	(0.69–1.96)
5–8			1.18	(0.73–1.93)	0.98	(0.57–1.69)
0–4			1.74	(1.03–2.92)	1.21	(0.65–2.24)

[a] All models are adjusted for own age and origin.
[b] Model 1 = own education; Model 2 = spouse's education; Model 3 = own + spouse's education.

supported by numerous studies showing that higher SES offers better preventive care, earlier diagnosis[30,31] and more aggressive treatment.[32] The association between SES in general, and education in particular, and prostate cancer is not as straightforward as for other cancers, however, and may involve several explanatory pathways. First, although incidence in prostate cancer is increasing owing to more sensitive screening techniques and refined diagnostic procedures,[33] physicians and patients may reject treatment owing to the type of cancer, changes in quality of life, and cost.[34] Next, there is suggestive evidence that the mutations in the BRCA genes, which are more prevalent in Ashkenazi Jews,[35] are associated with more aggressive prostate tumours.[36] In Israel, Ashkenazi Jews comprise much of the higher SES[37] and as such, these individuals of European descent may have a significantly greater burden of disease. Although in our analysis we adjusted for origin, a residual effect may remain. We, therefore, used a stratified analysis to assess the effect of education on prostate cancer mortality by origin (data not shown) but did not observe mortality differences. Finally, diet, which often reflects SES groups,[38,39] has been associated with prostate cancer risks.[33] Several recent studies indicated that α-linoelic acid (a polyunsaturated fatty acid found in vegetables and dairy products) and calcium increase the risk for developing prostate cancer.[33] Additionally, tomato products have been shown to have chemopreventive properties.[33] It may well be that in Israel established associations between nutrition and origin or educational levels explain these risks.[40,41]

No effect of educational attainment on mortality from breast cancer or non-breast cancer was observed for women, consistent with other studies showing equivocal or no associations.[16,25,42] These findings may be due to the complex relationship between cancer incidence and survival.[25,28] Also, these results might reflect the lifestyle of this birth cohort; namely, most women from this sample were housewives and not exposed to occupational carcinogens of later generations.[9]

Spouse's education and mortality

Much of the literature concerning spouse's affect on mortality has focused on the contribution of a wife's education to her husband's overall and CVD mortality.[43–45] By and large these studies examined middle-aged men with equivocal results that may be attributed to spousal personality characteristics and martial and non-marital stressors and support.[43,46]

In the present study, we found that on its own or after adjusting for one's own education, the educational achievement of a spouse also contributed to mortality, however, with notable variations by gender and cause of death. Also remarkable is the similarity of effect of own or spouse's education for almost all causes of mortality excluding cancer. This finding, although not specifically examined in this study, adds to the current debate concerning the use of a spouse's SES as a proxy for one's own position.[47,48]

For overall and CVD mortality both members of a couple benefit from a wife's increased education, while a wife's educational attainment had no observed effect on her own or her spouse's respiratory disease mortality or cancer mortality. Although little is known about elderly couples and cancer and respiratory disease mortality, these findings are consistent with several studies for middle-aged couples and all-cause and CVD mortality,[43–45] and may be explained by gender roles. In particular, we posit that a wife's influence on her husband's mortality results from her position as the primary determinant of home life[49] and of the family's health behaviours,[43,44] rather than the direct result of increased material circumstance dependent on the husband's education.[48]

Among husbands, higher educational attainment lowered their spouse's mortality risks for non-breast cancer. This is unexpected, in light of the finding that husbands' education does not contribute to their wives' CVD or respiratory mortality. In two recent studies examining the effect of middle-aged husbands' education on their wives' health, one showed an association for self-assessed health and smoking but not excessive alcohol consumption[48] while in the other, no relationship was observed for overall or CVD mortality.[50] We hypothesize that a husband's higher education is linked to greater material wealth, which may enable and facilitate cancer screening and proper treatment.[27] Indeed, for many cancers, survival for the aged is highly dependent on proper diagnosis, management, and treatment,[28] which may in turn be linked to material wealth.

Strengths and limitations

The Israel Longitudinal Mortality Study comprises one of the largest nationwide cohorts of elderly married couples, which incorporate predictor as well as outcome variables for both spouses. The results reported herein are based on information ascertained at the census date and do not account for subsequent changes in marital status or other potential confounders for example, smoking status and drinking habits that are not collected in a census. These confounders are not expected to have a marked effect on our results for several reasons. First, alcohol consumption among elderly Israeli's is substantially lower than in other industrialized countries.[51] Second, education may be considered a crude proxy for unhealthy behaviours, which are highly linked to SES.[52] Lastly, Bassuk *et al.*[3] posit, that SES-mortality differentials exist above and beyond these associations. Misclassification in coding causes of death could bias the findings if this was differential by educational level. Although, we do not have data to address this issue, it is unlikely that this was the case. Finally, the large, well-defined, and random sample of the Israeli population makes this dataset highly suitable for assessing education-related mortality differentials.

Our hypothesis that educational gradients in mortality exist in older ages, is not uncomplicated. On the one hand, we expected reduced gradients in mortality associated with social class among elderly since this age group has a higher representation of the healthy elite and those whose better social conditions promoted and enabled good health.[53,54] To be sure, the present study represents a healthier and higher socioeconomic segment of society—married and living independently.[12] On the other hand, older age groups represent the culmination of lifetime exposures and stressors and, therefore, should reflect greater social inequalities.[54]

We used educational attainment to predict mortality in the elderly. Although education is but one of the markers of SES, many studies assessing socioeconomic position prefer education to occupation or income since it is more readily determined for all individuals and is acquired early in life, thereby, unaffected by subsequent changes in health status.[18,52] When studying a spouse's influence on health, most researchers have used education and have shown that a partner's SES influence adds unique valuable information and is not a proxy for one's own socioeconomic position.[43–45,48] Despite our significant findings, this variable may be limited by the period effect for this specific cohort. Specifically, many in this cohort came from Europe, where wartime and poor economic circumstances may have led many to leave school at an early age, and thus restrict their full academic potential.

Conclusions

Clearly, among this cohort of independently dwelling married couples, educational gradients in mortality persist into older ages. Furthermore, above and beyond the effects associated with an individual's educational achievement, we now show that among elderly couples, a spouse's education is a strong predictor of one's own mortality with notable variations by gender and cause of death. Of specific import is our finding of the effects of an educated spouse on one's own risk of dying from cancer, namely, non-breast cancer mortality is predicted only by a husband's and not by one's own educational attainment. We demonstrated significant health risks associated with one's own and one's partner's educational achievement, which represents one dimension of social class. Research using partner's education as a proxy for one's own attainment, may be omitting valuable information regarding health risks.

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KEY MESSAGES

- Educational gradients in mortality persist into older ages.
- Above and beyond the individual's education, among elderly couples, a spouse's education is a strong predictor of one's own overall and cause-specific mortality.
- Research using partner's education as a proxy for one's own attainment may be omitting valuable information regarding health risks.

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