Sven Drefahl

How Does the Age Gap between Partners Affect their Survival?

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Max Planck Institute for Demographic Research
Konrad-Zuse-Str. 1, 18057 Rostock, Germany
Tel: +49(0)381 2081 111
Fax: +49(0)381 2081 411
Email: drefahl@demogr.mpg.de
http://www.demogr.mpg.de

1 Abstract

This paper uses hazard regression methods to examine how the age difference between spouses affect their survival. Research that analyzed the effect of a spouse on the mortality of a target person found that various predictors such as education, smoking habits, and social status affect survival chances. A further factor that influences the mortality of both partners is the age gap between them. In many countries, the age difference between spouses at marriage remained relatively stable for several decades. In Denmark, if considering all marriages, men are about 3 years older when they marry as women on average. Several authors analyzed the age gap between spouses in respect to mortality and found that having a younger spouse is beneficial, while having an older spouse is detrimental for ones own survival. Most of the observed effects could not be explained satisfyingly until now, mainly because of methodological drawbacks and insufficiency of the used data. The most common explanations refer to selection effects, care giving in later life, and some positive psychological and sociological effects of having a younger spouse.

The present study extends earlier work by using longitudinal Danish register data which includes the entire history of key demographic events of the whole population from 1990 onwards. Controlling for confounding factors such as education and wealth, results suggest that having a younger spouse is beneficial for men but detrimental for women while having an older spouse is detrimental for both sexes.

2 Introduction

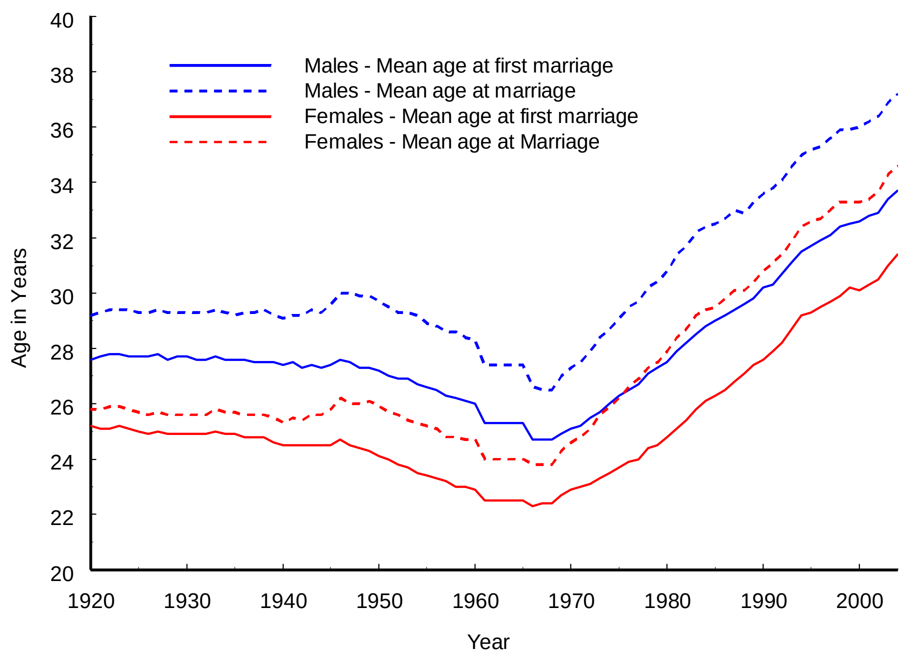
In recent years, the search for a single determinant of lifespan such as a single gene or the decline of a key body system has been superseded by a new view (Weinert and Timiras, 2003). Lifespan is now seen as an outcome of complex processes with causes and consequences in all areas of life, in which different factors affect the individual life span simultaneously. Today's standard of knowledge is that about 25 percent of the variation of human life-spans can be attributed to genetic factors and about 75 percent to non-genetic factors. Research focusing on non-genetic determinants of life span suggest that socioeconomic status, education, smoking and drinking behavior have a major impact on individual survival (e.g. Christensen and Vaupel (1996)). Mortality of individuals is also affected by characteristics of their partnership. Partnership as a basic principle of human society represents one of the closest relationships individuals experience during their lifetime. Regarding predictors of their mortality, partners usually share many characteristics such as household size, financial situation, number of children, and quality of the relationship. But there are also several factors that might affect partners differently, for example education and social status. A factor that might influence partners in different ways is the age gap between them.

3 Background

To describe age dissimilarities between spouses, three different theoretical concepts evolved in the last decades. The most common concept is *homogamy* or *assortative mating*, which presumes that people, predisposed through cultural conditioning, seek out and marry others like themselves. One assumption is that a greater age gap is associated with a higher marital instability. A further prominent concept is *marriage squeeze*, which states that the demand and supply of partners forces the individuals to broaden the age range of acceptable partners. A third and less common concept is the *double standard of aging*, which assumes that men are generally less penalized for aging than women. This assumption is supported by a greater frequency of partnerships of older men with younger women and much more variability in men's age at marriage compared to women (Berardo et al., 1993).

The age difference between spouses at marriage remained relatively stable for several decades in many countries, a fact that was described by Klein (1996) as an almost historical pattern. An example for such a stable pattern is shown in Figure 1. It shows that, if considering all marriages, Danish men are on average 3 years older at the time of their marriage than women. If only first marriages are considered, the gap between the sexes is a little bit smaller. While the mean age at marriage increased by about 6 years during the 20th century, especially since the end of the 1960s, the age difference between the sexes increased only slowly in the first 50 years of the 20th century and started to decrease again in the second half of the 20th century. Today, the difference between the mean age at marriage of Danish men and women is only slightly smaller than at the beginning of the 20th century.

Figure 1: Mean age at marriage in Denmark



Source: Compiled by author from data in Statbank Denmark (Denmark, 2006)

At the same time, marriage behavior in Denmark changed dramatically in nearly all other aspects, especially because divorce became more widespread. In 1901 the Danish Statistical Office counted 376 divorces. From then on the number of divorces increased steadily and reached its peak in 2004 with 15,774 registered divorces. This increase in the number of divorces as an alternative to end a marriage is important as it reflects dramatic changes in the way how marriages are dissolved. Until the early 1920's more than 90 percent of all marriages in Denmark were dissolved by the death of one of the spouses. This proportion decreased with time. Today only about 55 percent of all marriages are dissolved by the death of a spouse and about 45 percent by divorce.

Generally, most marriages that are dissolved by the death of one of the spouses end by the death of the husband. This is a universal pattern because men are not only older at time of marriage but also die younger as compared to women (Luy, 2002). At the beginning of the 20th century about 58 percent of all Danish marriages dissolved by death end due to the death of the husband and about 42 percent by the death of the wife. In the course of the 20th century Danish life expectancy increased for both sexes but much faster for women. While the difference in life expectancy at age 18 between the sexes was about 2.5 years in 1900 it was about 4.3 years in 2005 (HMD, 2002). This increase lead to an increase in the proportion of marriages that were dissolved by the death of the husband by about 10 percent. So, today about two thirds of all marriages that are dissolved by death end due to the death of the husband and only one third by the death of the wife.

Studies considering the impact of age differences between the partners on their mortality are rare and relatively old. Rose and Bell (1971) made one of the first attempts to quantify the influence of a spousal age gap on men's longevity. The authors found a correlation between longevity and having a younger wife, which was the 13th highest among all 69 variables they studied in their analysis.

The first study considering the impact of an age gap in both sexes was conducted by Fox et al. (1979). The authors concluded that "conformity to the social norm, of the man being older than his wife, is associated with relatively lower mortality for both parties" while differences from this norm, especially if they are extreme, will lead to higher mortality. Fox et al. (1979) speculate that this pattern might be driven by the different characteristics of those who form these unusual partnerships. In the 1980's two studies provided further insights into this topic. Foster et al. (1984) studied the effect of age differences on male mortality, while Klinger-Vartabedian and Wispé (1989) focused on females. Both studies used the same data and generally supported earlier findings. They concede that results regarding larger age gaps should be interpreted with caution, mainly due to insufficient data. As the direction of the observed effects were about the same, Foster et al. (1984) and Klinger-Vartabedian and Wispé (1989) draw similar conclusions. The first possible explanation, that healthier or more active individuals are selected by younger men or women, was already mentioned by Fox et al. (1979). Such individuals would have lived longer whomever they married because physical vitality and health usually coincides with an increased longevity. Another possible outcome of selection is that physical needs are better taken care of in later life for persons married to a younger spouse. The second possible explanation refers to spousal interaction. It is speculated that there might be something psychologically, sociologically, or physiologically beneficial about a relationship with a younger spouse. Furthermore it could be that intimate involvement with a younger spouse enlivens anybody's chances for a longer life. This explanation directly refers to psychological determinants of mortality like social and interpersonal influences, happiness, self-concept and social status.

The major drawbacks of all studies are that their data were limited to 5-year age groups, that the authors did not include any information about additional variables like duration of the marriage, that they were limited to married couples, and that they only included individuals whose spouses were still alive. The missing information on the duration of the marriage could probably lead to a selection bias because it is uncertain whether the marriages in the samples were of sufficient duration to allow for any effects on mortality. Foster et al. (1984) stated that an unobserved significant relationship between marriage duration and age of the spouse could question the generality of the observed mortality differentials (Foster et al., 1984).

In two more recent publications, historical data were used to identify a mortality pattern by the age of a spouse. Williams and Durm (1998) basically replicated the results of the studies mentioned earlier but their study also faced the same limitations. Kemkes-Grottenthaler (2004) used a set of 2,371 family related entries dating 1688-1921 of two neighboring parishes in Germany. She shows that the mortality differentials were not only determined by the age gap itself, but were affected by several covariates such as socioeconomic status and reproductive output. Regarding socioeconomic status it was found that age-heterogamy was much more prevalent in upper classes. In contrast to that, the reviews of Berardo et al. (1993) and Atkinson and Glass (1985) concluded that age-heterogamy was more common among lower classes and not more common among the higher educated. However, although findings are mixed, it indicates that confounding factors like socioeconomic status are of critical importance for the analysis of the mortality differentials by the age gap to the spouse.

In sum, previous research found that having a younger spouse is beneficial, while having an older spouse is detrimental for the survival chances of the target person. Most of the observed effects could not be explained satisfyingly until now, mainly because of methodological drawbacks and insufficiency of the used data. The most common explanations refer to health selection effects, care giving in later life, and some positive psychological and sociological effects.

4 Research Questions and Hypotheses

In this section I develop some hypotheses about the relationship between the age gap to the spouse and risk of dying. In my model, exposure to risk of mortality depends on the individual's own resources, those of their spouse, and their gender. Previous limitations are addressed by using detailed Danish register data in a time-dependent framework using Hazard regression.

In men the findings regarding the age difference to the spouse are relatively consistent. I hypothesize to find the same direction of the effect, namely that male mortality increases when the wife is older and decreases when the wife is younger.

Previous research also indicated that mortality by the age gap to the spouse differs between the sexes but none of the authors proposed reasons for that (Kemkes-Grottenthaler, 2004; Williams and Durm, 1998). As the most common explanations of mortality differences by age gap to the spouse like health selection, care giving in later life and positive psychological effects of having a younger spouse do not indicate differences by sex, I hypothesize to find the same effect of the age gap to the spouse in women, namely that the chance of dying increases when the husband is older and decreases when the husband is younger.

I also hypothesize that the duration of marriage has an impact on the mortality differentials by the age gap to the spouse. Previous studies speculated that marriages should be of sufficient duration to allow for any effects on mortality. This reasoning suggests that the mortality advantage of individuals that are younger than their spouses should not be observable in marriages of short duration.

In addition I will analyze the impact of the socioeconomic status. Previous research (e.g. Kemkes-Grottenthaler (2004)) indicates that the frequency of age-heterogamy is differing by social class. Generally higher educated persons and individuals with higher wealth are known to experience a lower mortality but no present study analyzed whether these socioeconomic variables might have an impact on the survival differentials by the age gap to the spouse. If the frequency of age-heterogamy is differing by social class it could partially explain these survival differentials. Thus, I hypothesize that the target person's and spousal socioeconomic characteristics will change the effect of the age gap to the spouse on the target person's mortality.

Previous research argued that social norms and the cultural background can explain the mortality differentials. Although Denmark is known to be a very homogeneous country, it is likely that social norms may differ between Danish and Non-Danish as well as between rural and urban areas. Thus, I hypothesize that mortality by age gap to spouse might differ by place of residence and by citizenship of the target person.

5 Data and Methods

5.1 Data

For the empirical analysis Danish data are used. Denmark is among the countries with the most sophisticated administration systems worldwide (Eurostat, 1995). All persons living in Denmark have a personal identification number which is assigned at birth or at the time of immigration into the country. This personal identification was a crucial part of the 1968's Population Registration Act, which introduced a computerized Central Population Register. This register serves as the source register for almost all major administrative systems in Denmark, which means that most registers can be linked by using the personal identification number. Today, many different authorities maintain about 2,800 public personal registers on almost all aspects of life. While the majority of these registers are administrative registers, a small proportion can be used for statistical or research purposes. Generally, the Danish registers are considered as a source of detailed and very exact information with a very low percentage of missing data. For this study, individual-level data from five different registers are linked with each other through the personal identification number. An overview about the registers that are used for this analysis is shown in Table 1.

Table 1: Registers and variables that are used in this analysis

Name of Register	Variables
Family Register	Sex, Date of birth, Marital status, Personal identification number of the partner, Citizenship, Municipality of Residence
Register of Deaths	Date of death
Migration Register	Date of migration, Type of migration
Education Register	Highest achieved educational degree
Income Register	Wealth

All the used registers are kept and maintained at Statistics Denmark and cover the whole observation period between 1990 and 2005. The information in the Family Register, the Education Register and the Income Register is updated annually, which means that the data is based on the individual's status at the 1st of January of each year during our observation period.

The variables *personal identification number of the partner*, *wealth*, *municipality of residence* and *citizenship* were coded as time-varying covariates. The covariate *age difference to the spouse* is also time-varying but was computed from existing variables. The variable *sex* is a time-constant covariate by nature, while *education* has been assumed to be time-constant despite of their time-varying nature inherently. My data set consists only of people aged 65 and over. At these advanced ages education is unlikely to change, so this approach should give approximately the same results. The remaining variables *marital status*, *date of migration* and *type of migration* as well as *date of birth* and *date of death* were used to define the time periods under risk.

The base population of my analysis consists of all married people aged 65 years and older living in Denmark between 01 January 1990 and 31 December 2005. There are three ways for individuals to enter the study:

- Being married and 65 years or older on 01 January 1990
- Being married and becoming 65 years old between 02 January 1990 and 31 December 2005
- Immigrating into Denmark between 01 January 1990 and 31 December 2005 being married and 65 years or older

To exit the study the following five ways are possible:

- Dying between 01 January 1990 and 31 December 2005
- Divorcing between 01 January 1990 and 31 December 2005
- Getting widowed between 01 January 1990 and 31 December 2005
- Being alive at the 31 December 2005
- Emigrating out of Denmark between 01 January 1990 and 31 December 2005

5.2 Methods

I apply hazard regression models to examine the influence of the age difference to the spouse on the individual's mortality. Hazard regression, also called Event-History analysis or Survival analysis, represents the most suitable analytical framework for studying the time-to-failure distribution of events of individuals over their life course. The general proportional hazards regression model is expressed by

$$h(t|X_1, ..., X_k) = h_0(t) \exp\left(\sum_{j=1}^{k} \beta_j X_j(t)\right) \tag{1}$$

where $h(t|X_1, ..., X_k)$ is the hazard rate for individuals with characteristics $X_1, ..., X_k$ at time t, $h_0(t)$ the baseline hazard at time t, and β_j, $j = 1, ..., k$, are the estimated coefficients of the model.

As the failure event in our analysis is the death of the individual, the baseline hazard of our model $h_0(t)$ is age measured as time since the 65th birthday. It is assumed to follow a Gompertz distribution defined as

$$h_0(t) = \exp(\gamma t) \exp(\beta_0) \tag{2}$$

where γ and β_0 are ancillary parameters which control the shape of the baseline hazard. The Gompertz distribution proposed by Benjamin Gompertz in 1825 has been widely used by demographers to model human mortality data. The exponentially increasing hazard of the Gompertz distribution is a useful approximation for ages between 30 and 95. For younger ages mortality tends to differ from the exponential curve due to infant and accident mortality. For the advanced ages it was found that the increase in the risk of death tends to decelerate so that the Gompertz model overestimates mortality at these ages (Thatcher et al., 1998; Vaupel et al., 1998). I assume that the impact of this deceleration on our results is negligible as the number of married people over age 95 is extremely low.

It was aimed to test whether the age difference to the spouse affect both sexes in the same way. Therefore, all models were calculated for females and males separately. It should be noted that the male and female models do not necessarily include the same individuals. Couples consisting of men married to women aged 64 and younger are not included in the female models and vice versa.

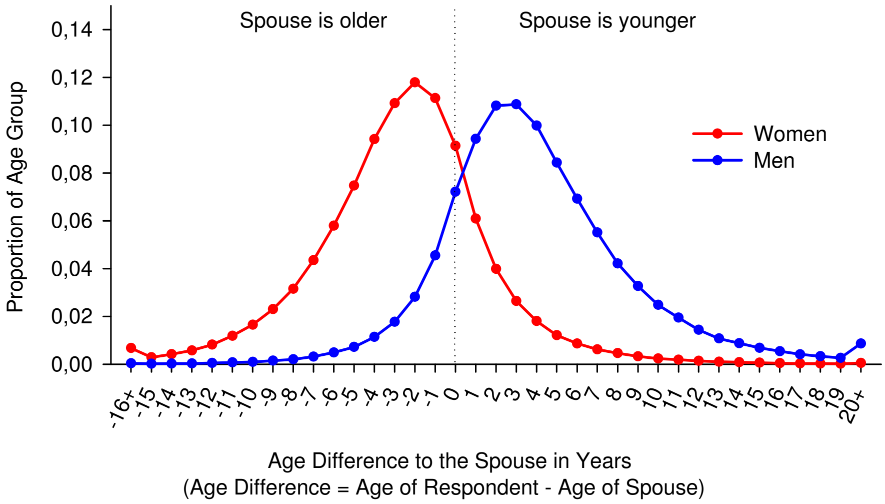
6 Results

In total 1,585,882 individuals aged 65 and older are included in our data set; 708,481 of them are male, 877,401 female. The distribution of all persons in my data set by age gap to the spouse is presented in (Figure 2). It shows that most men are between 2 and 3 years older than their wives while most women are 2 years younger than their spouses.

Approximately 75 percent of all married men aged 65 and over are married to a wive that is more than 1 year younger than themselves; only 10 percent of all men are at least one year younger than their wives. In contrast to that, the majority of married women (65 percent) aged 65 years and over is married to men that are older than themselves and only 15 percent have a spouse that is more than 1 year younger.

In a first step I estimated a model (Model 1) that allows me to replicate the results of previous studies by including *age difference to the spouse* as sole covariate. The results of this model, which is only controlled for the age of the target person and *age*

Figure 2: Age Differences to the Spouse



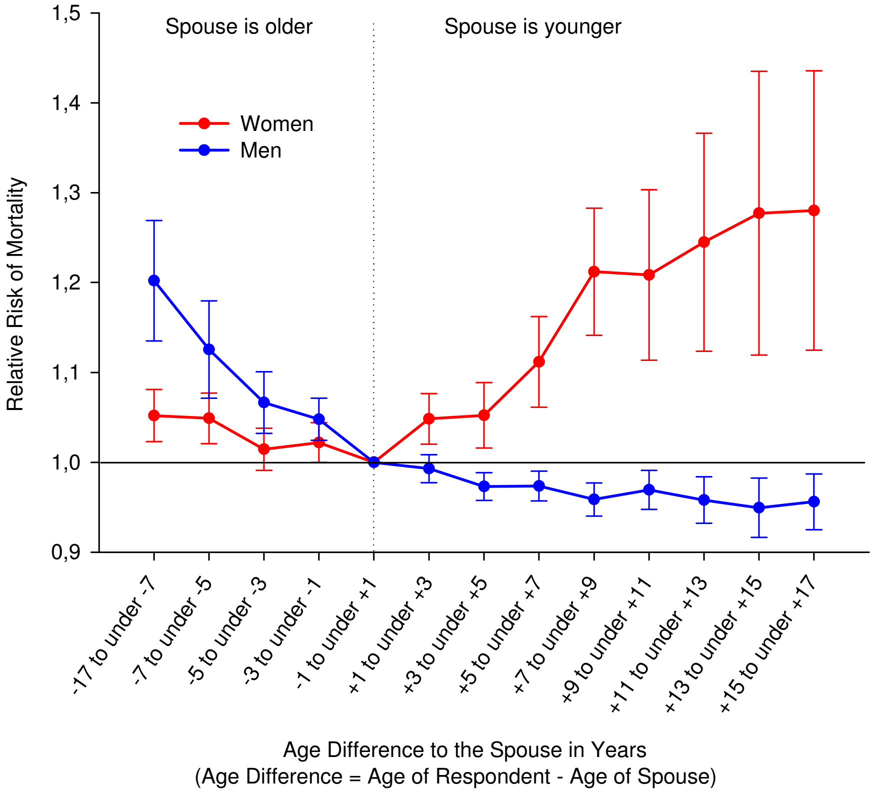
Source: Compiled by author with data from Statistics Denmark

difference to the spouse, is shown in Figure 3. Figure 3 consists of two separate curve showing the relative risk of dying by age difference to the spouse. The blue curve the relative mortality risk for married men, the red curve the risks for married women. The reference category comprises all persons that are less than one year younger or older than their spouses. The part of each curve that is left from the reference category relates to individuals with older spouses, the right part to individuals with younger spouses.

Figure 3 shows that the risk of dying in men is decreasing with increasing age difference to their wife, which means that the younger the wife is compared to her spouse, the lower the mortality in the husband and vice versa. Compared to the reference category, an excess mortality of more than 20 percent can be found in married men that are more than 7 but less than 17 years younger than their wives. Married men that are more than 15 years but less than 17 years older have a chance of dying that is 4 percent lower.

Similar to men, female mortality is higher if the wife is younger than her husband. Women that are more than 7 but less than 17 years younger have an excess mortality of about 5 percent. In contrast to the pattern in men, women also have an elevated risk of dying when they are older than their spouses. Compared to the reference category, an excess mortality of 28 percent is observed in women that are more than 15 but less than 17 years older than their spouses. The lowest risk of dying is found in women who are about the same age as their husbands; which is the reference category.

Figure 3: Relative Risk of Dying by Age Difference to the Spouse (Model 1)



Source: Compiled by author with data from Statistics Denmark

These first results provide strong evidence that the age difference to the spouse affect individual survival chances. It also shows that the effects are substantially different between the sexes. Next, in models 2, 3, and 4 I examine the impact of the age gap to the spouse in the presence of additional covariates. The results of these models are presented in Table 2.

Previous research had no information on the duration of marriage which could lead to a possible selection bias. Model 2, which includes *duration of marriage*, allows me to test for the confounding effect of duration of marriage. A comparison of the coefficient for the age gap to the spouse in Model 1 and Model 2 shows that including the measure of marriage duration does not change the coefficients for the age gap to the spouse, suggesting that the *duration of marriage* does not account for the mortality differences of age-discrepant marriages. In results not shown here I tested an additional model that included an interaction between *age difference to the spouse* and *duration of marriage*. None of the combinations between the two variables were statistically significant (at the .05 level).

Table 2: Effect of the age gap to the spouse, highest achieved education, and wealth on the hazard of mortality

		Men			Women		
Covariate		Model 2	Model 3	Model 4	Model 2	Model 3	Model 4
Age gap to the spouse (in Years)	-40 to -17	1.20	0.89	0.95	1.40*	1.54**	1.57**
		(0.535)	(0.399)	(0.426)	(0.204)	(0.225)	(0.231)
	-17 to -7	1.19***	1.09**	1.12***	1.05***	1.07***	1.08***
		(0.035)	(0.032)	(0.033)	(0.015)	(0.015)	(0.017)
	-7 to -5	1.12***	1.08**	1.10***	1.05**	1.05**	1.05***
		(0.028)	(0.027)	(0.028)	(0.015)	(0.015)	(0.015)
	-5 to -3	1.06**	1.04*	1.05**	1.02	1.01	1.01
		(0.018)	(0.017)	(0.018)	(0.012)	(0.012)	(0.012)
	-3 to -1	1.04***	1.02*	1.03*	1.02*	1.02	1.02
		(0.012)	(0.012)	(0.012)	(0.011)	(0.011)	(0.011)
	-1 to 1	1	1	1	1	1	1
	1 to 3	0.99	0.98*	0.98**	1.05**	1.06***	1.05***
		(0.008)	(0.008)	(0.008)	(0.015)	(0.015)	(0.015)
	3 to 5	0.97**	0.95***	0.94***	1.05*	1.06**	1.05**
		(0.009)	(0.008)	(0.008)	(0.019)	(0.019)	(0.019)
	5 to 7	0.97**	0.95***	0.93***	1.11***	1.12***	1.11***
		(0.009)	(0.008)	(0.008)	(0.026)	(0.026)	(0.026)
	7 to 9	0.95***	0.91***	0.89***	1.20***	1.21***	1.19***
		(0.009)	(0.009)	(0.009)	(0.037)	(0.037)	(0.037)
	9 to 11	0.97**	0.90***	0.88***	1.20***	1.22***	1.20***
		(0.011)	(0.010)	(0.010)	(0.050)	(0.051)	(0.050)
	11 to 13	0.96**	0.89***	0.86***	1.24***	1.26***	1.23***
		(0.013)	(0.012)	(0.012)	(0.065)	(0.066)	(0.065)
	13 to 15	0.95**	0.87***	0.84***	1.26**	1.23**	1.20**
		(0.017)	(0.015)	(0.015)	(0.084)	(0.083)	(0.081)
	15 to 17	0.96**	0.86***	0.83***	1.27***	1.26***	1.22**
		(0.016)	(0.014)	(0.014)	(0.083)	(0.082)	(0.080)
	17 to 40	0.94***	0.82***	0.79***	1.33**	1.39**	1.33**
		(0.023)	(0.017)	(0.017)	(0.136)	(0.143)	(0.137)
Duration of marriage	Unknown	0.86***	0.80***	0.79***	0.84**	0.76***	0.77***
		(0.030)	(0.028)	(0.028)	(0.051)	(0.047)	(0.048)
	< 1000 days	1	1	1	1	1	1
	≥ 1000 days	0.85***	0.93*	0.92*	0.87**	0.82**	0.83**
		(0.029)	(0.032)	(0.032)	(0.052)	(0.049)	(0.050)
Period	1990 - 1994	1.07***	1.04***	1.04***	1.06***	1.00	1.01
		(0.008)	(0.007)	(0.008)	(0.012)	(0.011)	(0.012)
	1995 - 1999	1	1	1	1	1	1
	2000 - 2005	0.86***	0.88***	0.88***	0.90***	0.94***	0.93***
		(0.005)	(0.005)	(0.005)	(0.008)	(0.008)	(0.009)
Highest achieved education	Low		1.06***	1.03**		1.10***	1.07***
			(0.008)	(0.008)		(0.012)	(0.013)
	Medium		1	1		1	1
	High		0.86***	0.90***		0.86***	0.90***
			(0.010)	(0.010)		(0.018)	(0.019)

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Table 2: Effect of the age gap to the spouse, highest achieved education, and wealth on the hazard of mortality (Continued)

		Men			Women		
Covariate		Model 2	Model 3	Model 4	Model 2	Model 3	Model 4
Wealth	Low		1.52***	1.53***		1.25***	1.25***
			(0.013)	(0.013)		(0.017)	(0.018)
	Medium			1			1
	High		0.60***	0.59***		0.64***	0.64***
			(0.003)	(0.003)		(0.006)	(0.006)
Highest achieved education of the spouse	Low			1.07***			1.06***
				(0.007)			(0.013)
	Medium			1			1
	High			0.88***			0.89***
				(0.011)			(0.016)
Residential Area	Copenhagen			0.95***			1.10***
				(0.006)			(0.010)
	Remaining Denmark			1			1
Citizenship	Danish			1.33***			1.14**
				(0.040)			(0.054)
	Non-Danish			1			1
Constant		-16.07	-15.81	-15.90	-16.83	-16.89	-17.10
Gamma		0.00027	0.00027	0.00027	0.00028	0.00028	0.00028

SEs are in parentheses
*** < p 0.001
** < p 0.010
* < p 0.050

In Model 3 of Table 2 I test the hypothesis that socioeconomic status affects the mortality differentials by the age gap to the spouse. This model includes measures of the target person's *highest educational degree* and *wealth* as well as the variables already included in Model 2. The results show that both socioeconomic variables are important predictors of survival differences. Individuals with low education or low wealth face higher mortality rates. When we compare the relative risk by age difference to the spouse in Model 3 with the relative risk by age difference to the spouse in Model 2, we see that holding the socioeconomic variables constant changes the effects for both sexes. For men, adding these measures to the model reduces the relative risk of dying when they are younger than their wives but increases the survival advantage when they are older than their wives. For women, adding measures of socioeconomic status had virtually no impact when they are younger than their husband but slightly increased the chance of dying when they are older than their husbands. In results not shown here I tested an additional model that included an interaction between the socioeconomic variables and the age gap to the spouse. One of the combinations was statistically significant (at the .05 level). Men with high wealth and that are older than their wives experienced a significantly elevated risk of dying of about 5 percent. All remaining combinations between the variables were not statistically significant (at the .05 level).

Finally, I investigated the effect of the remaining variables *residential area*, *citizenship*, and *Highest achieved education of the spouse* which are introduced into the analysis in Model 4 of Table 2. In this model I wanted to test the assumption that cultural differences and social norms represented by the two variables *residential area* and *citizenship* account for some of the differences in the hazard of mortality by the age gap to the spouse. Again, if comparing the relative risk by age gap to the spouse in this model with the relative risk by age gap to the spouse in Model 3, we see differences by sex. For men, the hazard of mortality increased when they are younger than their wives and decreased further when they are older than their wives. In contrast to that, the hazard of mortality for women did not change for women that are younger than their husbands but decreased considerably for women that are older then their husbands.

7 Discussion

The current study addresses an underdeveloped research area. Using Danish population data, I utilize hazard regression methods to exploit 15 years of age-specific data to investigate the effect of the age difference to the spouse on the individual's survival. It was shown for the first time that survival differences by age gap to the partner are not limited to extreme cases but statistically significant for small age differences. Individuals that were about 1 to 3 years older than their spouses had a significantly different survival than individuals that are up to 1 year older or younger than their spouses.

My test of the hypothesis that the effect will be the same in men and women receives no support. My results suggest that having a younger spouse is beneficial for men but detrimental for women. It is also shown that controlling for additional covariates weakens the effect of the age gap to the spouse in women but not in men. The first possible reason of sex differences could be differences in the health selection. The selection hypothesis argues that healthier individuals are able to attract younger partners. Therefore, married people that are older than their spouses should experience a lower mortality. It was also proposed in the literature that a younger spouse is somehow beneficial in terms of health care support as well as in some positive psychological and sociological ways. Both arguments should hold for both sexes similarly. The sex differences could indicate that health selection is weaker in women. Women are much less likely to marry a younger husband, which suggests that exceptionally healthy women are less able to attract a younger partner than their male counterparts. However, future analysis should include health indicators to investigate the pathway of a possible health selection in more detail.

A second reason of sex differences by the age differences to the spouse is related to social support. A large body of research found that women have generally more social contacts than men. This would suggest that women are probably less dependent on the health support and social support of a younger spouse than men, which means that a younger spouse would be less beneficial for women's survival than for the survival of men.

My results also suggest that the possible selection bias caused by an insufficient length of partnership Foster et al. (1984) and Klinger-Vartabedian and Wispé (1989) is of no importance in explaining the effects of the survival differences by the age gap to the spouse.

Previous research suggest that selection and discrepancy from the social norm are causing the mortality difference by the age difference to the spouse. The latter explanation was proposed in the 1970's were social norms regarding mating behavior in general and especially regarding the age difference between partners were probably much stronger than today. The explanation is supported by this investigation for men but not for women. If social norms regarding the age gap to the spouse would be the driving force of the observed mortality differentials female mortality is assumed to be lowest at ages where the women is a few years younger than their spouse. Here, I found that mortality in women is lowest when a woman is in the same age as their husband and increases with increasing age discrepancy.

I extend previous research of this area in several aspects. First, I apply a longitudinal approach. By using the Danish registers it is possible to track all individuals from the date of their marriage until their date of death and to incorporate all events like the death of their spouse, a divorce or a remarriage into the analysis that happened within the observed period. The longitudinal approach avoids some of the drawbacks of earlier studies.

Another limitation of previous research that I overcome in this study is the age grouping into 5-year age groups. Because of the age grouping in earlier studies each of the spouse-age-difference intervals covered an 8-year period. Spouses who were stated as being in the same age group could differ plus or minus 4 years, while the difference for an individual that is married to a spouse in the neighboring age group varies from 1 to 9 years. Thus, the age groups are not only wide but also overlapping. In my data set the exact date of birth is known for every individual, thus age and the age difference to the spouse are measured in days.

A further extension of previous research is also related to the data set. My study is using population data / register data to test these hypotheses and not samples as it was done in previous research. Many problems related to sampling methods are avoided, while the statistical power is increased substantially.

It can be concluded that the driving force of the observed mortality differences by the age gap to the spouse remain still unclear. Further research is necessary utilizing models that test for additional multiplicative effects as well as for unobserved heterogeneity. A shortcoming of this study is that it does not include any behavioral or psychological aspects of the married couple because the data came from administrative registers. Future research should point in this direction as it is assumed to be of importance to account better for social values and norms as well as certain behavioral aspects.

There are further research directions that are of possible interest. In general, the age difference to the partner should affect the survival chances of couple members in all kind of longtime partnerships between two individuals. Due to data limitations all studies that were done until now, including the present one, were not able to analyze all kind of partnerships, but had to focus on married couples exclusively. In a next step it might be of great interest to know whether the effects of the age gap to the partner can also be observed in longtime cohabiting couples or other kind of partnerships, especially in homosexual individuals.

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