Parity and Mortality in Finnish Men and Women:

Do Living Conditions in Childhood and Adulthood Explain the Association?

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INTRODUCTION

Despite a long research tradition in studying the relationship between the number of children and mortality in later life, empirical evidence is still inconclusive, and our understanding of the underlying mechanisms is limited (Hurt, Ronsmans & Thomas 2006). Most of the previous studies on contemporary populations are on women, and evidence for men is scarce (Hank 2010, Grundy, Kravdal 2010, Grundy, Kravdal 2008).

Systematic evidence for contemporary female populations indicate that the mortality of women with no children or only one child is often higher than mortality of women with two children, independent of age, marital status and various other socio-demographic confounders (Hurt, Ronsmans & Thomas 2006, Grundy, Kravdal 2010). In addition, several studies suggest that the mortality of mothers of at least four or five children is higher than that of mothers of two children (Grundy, Tomassini 2005, Manor et al. 2000, Doblhammer 2000). This U-shaped or reversed J-shaped relationship between the number of children and mortality has been observed among women who have completed their childbearing at least in England and Wales, the United States, Austria, and Israel (Hurt, Ronsmans & Thomas 2006, Grundy, Tomassini 2005, Manor et al. 2000, Doblhammer 2000). A recent study from Norway, however, showed that mothers of five or more children did not experience an elevated mortality compared to those with two children. It was suggested that the family friendly policy applied in Norway could have buffered the stresses of childbearing (Grundy, Kravdal 2008). Similarly, another Nordic study suggested that the mortality of Finnish women with five to nine children was somewhat lower compared to the national average (Hinkula et al. 2006). The Finnish study did not, however, allow control for confounding factors other than age, or examination of the risk of mortality by individual number of births.

Studying the relationship between reproductive history and mortality is problematic because they share common determinants (Hurt, Ronsmans & Thomas 2006). Hurt et al. (2006) have argued that failure to adjust for socio-economic status could result in an overestimation of a negative association between high parity and survival, as poorer women tend to have higher fertility and lower survival. In addition, also the positive effects of childbearing could easily be overestimated, as women with severe health problems and lower survival may remain childless. The most consistent results available relate to certain hormonally related cancers in women, as increasing parity has been shown to be protective against breast cancer in many studies (Clavel-Chapelon, E3N-EPIC Group 2002, Negri et al. 1988, Collaborative Group on Hormonal Factors in Breast Cancer 2002, Britt, Ashworth & Smalley 2007). In addition, high parity has been shown to be associated with a lower risk of death from cancers of the ovary and uterus (Hinkula et al. 2006, Kvale, Heuch & Nilssen 1994).

Studies on contemporary male populations are rarely available. The evidence for Norwegian men suggested a reversed J-shaped relationship between the number of children and mortality, with fathers of at least four children having an elevated mortality, which, however, weakened after socio-demographic confounders and the timing of first birth was controlled. The excess mortality of the nulliparous and fathers of only one child remained significant (Grundy, Kravdal 2010). Other studies on men are rarely available, and they mostly report no clear relationship between the number of children and all-cause mortality (Hank 2010, Friedlander 1996).

However, high parity has been suggested to be associated with coronary heart and circulatory diseases not only in women, but also in men (Dekker, Schouten 1993). The association and its biological and social mechanisms are still debated. In a study of Dutch civil servants and their spouses, Dekker and Schouten (1993) found that married women with four or more children had higher mortality from coronary heart disease than those with no children, even after adjustment for blood pressure, cholesterol level, body-mass index, smoking, and income level. This result for women is in line with an earlier study of Ness et al. (1993) who found an increased risk of cardiovascular disease among American women with high parity, independent of educational level. Dekker and Schouten (1993) suggested, however, that besides the biological pregnancy-related factors, socioeconomic and emotional factors, and lifestyle could make an important contribution to the association between high parity and coronary heart disease. The fact that similar indicative effect, although not significant, was found also among married Dutch men supports the importance of non-biological mechanisms (Dekker, Schouten 1993). Similarly, in a Norwegian study, Grundy and Kravdal (2010) found that both male and female mortality from circulatory diseases was somewhat higher among those with at least four children compared to those with two children. The association disappeared, however, after adjustment for demographic characteristics, education and timing of first birth.

It has been suggested that total parity and age at first birth could be influenced by childhood circumstances that also affect health and later-life mortality (Grundy, Kravdal 2008). However, no studies have examined the association between total parity and later-life mortality controlling for a large set of childhood characteristics with no recall bias. Some studies contained information on father’s education (Grundy, Kravdal 2008, Henretta 2007), but the variable is often subject to a large number of missing values. In an American study, Henretta (2007) showed that over-60-year-old women with at least five children had higher mortality compared to those with only two children, and that the risk of death associated with high parity was explained by race, nativity, and father's education. The individual contribution of father's education in explaining the association was, however, not reported. On the contrary, the same study suggested that father's education did not have any major role in explaining the negative association between early childbirth and later female survival, which remained significant in older women, net of all demographic and socioeconomic characteristics available.

Our study examined whether the number of children ever born was associated with mortality after the age of 45 in Finnish men and women, and whether the association could be explained by living conditions in childhood and adulthood. Both all-cause and cause-specific analyses were executed (but only results on all-cause mortality are attached).

MATERIALS AND METHODS

Data sample

This study was based on a 10% household sample drawn from the 1950 Finnish census with a mortality follow-up from 1970 to 2007 and almost complete records on reproductive history. The childhood sample was linked with quinquennial censuses from 1970 to 1995 providing information from adulthood.

Reproductive history

Information on live births registered to index person enabled us to construct complete fertility histories at age 45. The birth of a child was systematically registered to the files of the parents from 1970 onwards via social security numbers. Children born before that were linked to a parent only if they still lived together with the parent at the time of the 1970 census. Stillborn children or those who died before 1970 were not covered in the data. Children received through adoption were excluded. The fertility of women as observed in our data corresponds well with levels reported earlier on Finland on the corresponding female cohorts (Andersson et al. 2009).

Mortality

The data included month-level information on the time of birth and death (on deaths on from 1970 onwards) for the study cohort of 1938-50. The mortality follow-up was set to start at the age of 45 and ended at the end of 2007. The causes of death were grouped into seven broad groups of causes for men and eight causes for women.

Living conditions in childhood and adulthood

Information on living conditions in childhood originated from the 1950 census, at the time of which the study participants were 0-12 years old. The census provided information on the type of family, father's education, the size of the field cultivated by parents, detailed housing conditions, region of residence at birth, and language.

Information on living conditions in adulthood is based on quinquennial censuses between years 1970 and 1995. We used information on region of residence, marital status and a wide range of variables measuring socioeconomic position and housing conditions, which were measured at the age of 40-44. Socioeconomic position was measured by the level of education, occupation-based social class, labour force status, home ownership, personal taxable income, and housing conditions. Income was adjusted for inflation, and categorized into euros of the year of 2012. Housing conditions were measured with the level of equipment in a dwelling at 40-44 years and with a housing history of ever lived in a crowded dwelling at the age of 30-44 years.

Methods

Cox proportional hazard regression models were used in the analysis. Results from these models are reported as hazard rations with 95% confidence intervals. The clustering in the data (by households) was taken into account in the estimation of standard errors.

RESULTS

All-cause mortality

Adjusting for year of birth, men and women with no children had the highest mortality followed by those with only one child. Fathers of at least four children had higher mortality than fathers of two children, while the mortality of mothers of at least four children was not significantly elevated (table 1). Mortality of mothers and fathers of three children was as low as that of the parents of two children. Adjustment for childhood living conditions had only modest effect on the relationship between parity and mortality, especially in women (model 2 vs. model 1).

Controlling for marital status in adulthood had a large impact on the mortality estimates. The excess mortality of the nulliparous was mainly related to their higher likelihood of being never married and that of the parents of one child to their higher likelihood of being divorced compared to the parents of two children. Controlling for the level of education had somewhat different effects on the relationship between parity and mortality for men and women. In men, a reduction in mortality estimates was observed among all parity groups with an excess mortality, while in women no such reduction was observed among the nulliparous. The nulliparous women had a higher mortality than those with two children despite of their higher educational level.

Controlling for various other socioeconomic characteristics in adulthood weakened the relationship between parity and mortality (model 3 vs 4). The reduction was largely related to an early retirement, which was associated both with a higher mortality risk and nulliparity in both genders. Controlling for income was important in men.

In the fully adjusted model for men, the excess mortality of the nulliparous was reduced by over 75% after controls for all living conditions in childhood and adulthood but still remained significant (model 4 vs. 1). In turn, the excess mortality of fathers of only one child or those with at least four children was no longer significant after all controls. In women respectively, the excess mortality of the nulliparous was reduced by altogether 60% but remained significant in the full model. Also the excess mortality of the mothers of one child remained significant even if it was reduced by over 30 % following controls for all living conditions in childhood and adulthood.

DISCUSSION

A reverse J-shape relationship between parity and all-cause mortality was observed in Finnish men. The relationship was largely related to circulatory diseases, the mortality of which was not only elevated among the childless and the fathers of one child but also among the high-parity fathers. Our result is similar to that observed in a Norwegian study, in which the J-shape relationship between parity and male mortality from circulatory diseases persisted following controls for various demographic characteristics, including marital status and education ((Grundy, Kravdal 2010), (table 4: model 3), although it weakened in fully adjusted models. In our study, a high male mortality of the childless was also related to alcohol-related diseases.

Among Finnish women born in 1938-50, mortality of mothers of at least four children was not significantly elevated compared to the mothers of two children. This is similar to results from another Nordic study showing that mortality of the Norwegian mothers with at least four children was not higher than that of mothers of two children (Grundy, Kravdal 2010), but different from a study from England and Wales where high parity mothers experienced higher mortality (Grundy, Tomassini 2005). It has been argued that a high parity would not be associated with a higher female mortality in Nordic countries because of generous support for parenthood from the welfare state, which ease the economic strain of parenthood (Grundy, Kravdal 2010).

However, not surprisingly, an excess mortality was observed in the nulliparous Finnish women and in mothers of only one child. Although the excess mortality of the low parity mothers and that of the nulliparous remained significant following controls for various childhood and adulthood living conditions, the mortality estimates were largely reduced – especially in the nulliparous women. The two factors that were the most important in explaining the excess female mortality of the nulliparous were adulthood marital status and labour force status. The latter factor, which included information on an early retirement, is likely to have also measured indirectly individuals' health. As being officially retired at such an early age of 40-44 years was relatively common in the nulliparous (over 10 %), it is plausible to believe that a reasonable share of these retirees had health problems already in younger adulthood, which may have not only prevented them from working but also lowered their likelihood of having children. It is likely that a large part of the excess mortality of the nulliparous women (apart from cancers of the female organs) relates to selection due to bad health and not only to causal effects of childlessness.

CONCLUSIONS

The novelty of our study was that it allowed for controlling for detailed childhood and adulthood living conditions in analyzing the relationship between parity and post-reproductive survival. Our study was the first to indicate that even the most detailed information on family and socioeconomic characteristics from childhood had only a minor role in explaining the relationship. Our study indicated that in addition to marital status, detailed information on socioeconomic position from adulthood – and not necessary from childhood – is needed in order to enhance our understanding on the association between parity and survival. Although childhood living conditions had a minor role in our current study, they could have a larger role in explaining the association of survival with other aspects of fertility, for example the timing of first birth. Further research in this area is needed. In addition, further studies including information on health in childhood are sorely needed in order to tackle the problem of health related selection into parenthood.

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Table 1. Association between parity and mortality after the age of 45 (Hazard ratios and 95% confidence intervals),
Finnish men and women born in 1938-50

Men	n= 44648, 6299 died					
	Model 1		Model 2	Model 3	Model 4	
Number of children						
0	2.06 *	(1.94 - 2.20)	2.03 *	1.39 *	1.23 *	(1.12 - 1.35)
1	1.26 *	(1.17 - 1.36)	1.24 *	1.10	1.06	(0.99 - 1.15)
2 (ref.)	1.00		1.00	1.00	1.00	
3	0.98	(0.90 - 1.06)	0.98	0.99	0.96	(0.88 - 1.04)
4+	1.23 *	(1.11 - 1.35)	1.23 *	1.20 *	1.10	(0.99 - 1.21)

Women	n=42318, 2711 died					
	Model 1		Model 2	Model 3	Model 4	
Number of children						
0	1.86 *	(1.68 - 2.06)	1.85 *	1.47 *	1.33 *	(1.16 - 1.53)
1	1.36 *	(1.22 - 1.51)	1.35 *	1.25 *	1.24 *	(1.11 - 1.38)
2 (ref.)	1.00		1.00	1.00	1.00	
3	0.96	(0.86 - 1.09)	0.96	0.96	0.91	(0.80 - 1.03)
4+	1.10	(0.95 - 1.28)	1.09	1.06	0.92	(0.79 - 1.07)

* p<0.05

Model 1:	**Parity + cohort**
Model 2:	**Model 1 + childhood living conditions**
	Including family type, father's education, home ownership, size of field cultivated by parents type of cooker in a dweling, electric light , type of heating, piped water, washing possibilities number of persons per room, region of residence at birth, language
Model 3:	**Model 2 + basic variables from adulthood**
	Including region of residence + education + marital status at 40-44 years
Model 4	**Model 3 + more variables from adulthood**
	Including occupation based socioeconomic position, labour force status, home ownership, personal taxable income (corrected for time changes in consumer prices), and level of equipment in a dwelling at 40-44 years, and ever lived in a crowded dwelling