Parity and men's mortality risks

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Abstract

Background: Most studies on associations between parity and mortality focus on women, and find a negative correlation or U-shaped pattern. If and why having children is associated with mortality among men is less clear. Our objective was to improve understanding of the association between men's parity and mortality, and to investigate mechanisms potentially underlying this association. **Methods**: Analysis of baseline data (1991) from a prospective cohort study (the GLOBE study) with almost 17 year mortality follow-up among 4.965 men, aged 45 and over. Cox proportional hazard hierarchical regression models were used to link parity to mortality and to explore the role of SEP, health behaviors, and partner status. **Results:** Fathers of 2 or 3 children (HR 0.85; 95 % CI 0.74-0.99) and especially fathers of 4 or more children (HR 0.81; 95 % CI 0.69-0.95) had lower mortality risks compared to childless men. However, this association attenuated to non-significance after adding SEP, health behaviors, and partner status to the model. **Conclusions**: Our findings suggest that childless men have higher mortality risks in comparison to men who have fathered two or more children. **Keywords:** men, parity, health behaviors, partner status, educational attainment, mortality

Introduction

There is a growing recognition that reproductive patterns may have long-term health implications. Thus far, most studies on associations between parity and mortality focus on women[1]. Few studies have addressed the impact of parity on men's mortality risks, which provides mixed evidence. Some Israeli and US-studies find a U-shape pattern[23]. Norwegian data show enhanced mortality risks only for childless men and for those with one child[4], whereas American data show a protective impact of childlessness for men's mortality risks[5]. Finally, there are studies that show no impact of parity on men's mortality risks[678].

Several factors may explain the association between parity and mortality. Firstly, the association between having children and mortality might be attributable to men's socio-economic position (SEP). Fathers generally have a higher SEP compared with childless men[9], and as those with a higher SEP have lower mortality risks[10], differences in socio-economic position between parity groups may explain the association. Secondly, having children may affect mortality risks by encouraging men to behave in healthy ways. Having children means that men refrain from health-compromising behavior[11]. Therefore, differences in health behaviors between parity groups may explain the association. Thirdly, the higher likelihood of fathers as compared to childless men to have a partner may explain the link between parity and mortality, as having a partner is protective against mortality, especially for men[12]. Therefore, differences in partner status between parity groups may explain the association. Few studies have explicitly explored the role of these factors; inclusion of these intermediary factors in some but not all studies may be one reason for mixed evidence in the literature.

As evolutionary models suggest[13] that the number of children, rather than having had children per se, matters for mortality risks, we compare childless men with three categories of

fathers; those with one child, those with two or three children and those who have four or more children to find out whether it is having children or the number of children men have fathered that influences men's mortality risks. The aim of this paper is to explore the association between parity and all cause mortality among Dutch adult men, and to investigate potential mechanisms underlying this association.

Methods

Data from a Dutch prospective cohort study, the GLOBE study, was used to examine the association between parity and mortality among men. GLOBE is the Dutch acronym for Health and Living Conditions of the Population of the city Eindhoven and surroundings. The study started in 1991 with a baseline postal survey in which 18.973 individuals participated (response rate = 70 %)[14]. For the current analysis, the sample was restricted to men above 45 years at baseline. We chose to omit individuals under the age of 45 at the time of the interview because their parity status may not yet be permanent. Note, however, that the likelihood of having a first child at age 45 and over is small[15], especially for the men studied here (born between 1916 and 1946). The age restrictions left us with a total of 5.659 male respondents. In 2008, the data of all respondents were matched with population registry data from Statistics Netherlands. The Netherlands has a population register in which a unique number identifies every resident. Record linkage, performed by means of this unique identification number, provided us with information on vital status almost 17 years after the interviews were held. Given that all respondents living in the Netherlands have this unique identification number, the matching procedure led to near-perfect, confirmed matches for all survey respondents living in the Netherlands. Persons who emigrated during follow-up were no longer in the population registers, and for those individuals,

our observation period ends at time of emigration (n=79). After excluding persons with missing values on the variables of interest, the population for analysis consisted of 4.965 men.

Variables

Mortality is the dependent variable of interest, coded 1 if the respondent had passed away, 0 if still alive. Both the month and year of death were obtained from Statistics Netherlands. We calculated the number of months respondents were alive between the baseline measurement (April 1, 1991) and death or the last month of observation, December 31, 2007.

Parity. In the baseline survey, respondents were asked: "Do you have children? And if so, how many?" No distinctions between biological, step- or adopted children were made. Four categories were constructed: 1) men with 1 child, 2) men with 2 or 3 children and 3) men with 4 or more children and 4) childless men (reference category).

We incorporated two measures of SEP, namely occupational class and educational attainment, to account for different aspects of SEP. *Occupational class*. If respondents were employed, they were asked to report on their current occupational status. If they were not employed, they were asked to report on the occupational status of their last job. Respondents received an occupational prestige score according to the Erikson Golthorpe Portocarero classification scheme, and were subsequently divided into six groups ranging from manual unskilled workers (1) to higher professionals and managers (6)

Educational attainment. Respondents were asked about the highest level of education they had finished with a diploma. Four groups were distinguished: those with 1) primary school only (reference category), 2) lower vocational or lower general secondary education, 3) intermediate general secondary education or upper general secondary education, and 4) higher vocational education or university.

Alcohol use. Alcohol use was measured with two questions. The first focused on the average number of days a week the respondent consumed alcohol. The second focused on the average number of alcoholic beverages the respondent consumed on drinking days. Respondents were coded as total abstainers when they reported to never consume alcohol. Respondents were coded as light drinkers when they consumed six or more alcoholic beverages once a week, four to five alcoholic beverages twice a week, two to three alcoholic beverages three times a week or one alcoholic beverage every day of the week. Respondents were coded as moderate drinkers when they consumed six or more alcoholic beverages twice a week, four to five alcoholic beverages three or four days a week, or two to three alcoholic beverages four or more days a week. Respondents were coded as heavy drinkers when they consumed six alcoholic beverages three to four days a week, or four to five alcoholic beverages five or more days a week. Respondents were coded as very heavy drinkers when they consumed six or more alcoholic beverages more than five days a week. Because of the low number of respondents who fell into the last category, these respondents were combined with the heavy drinkers. Light drinkers were used as the reference category.

Smoking. Respondents were asked whether they had ever smoked, whether they currently smoked and how many cigarettes/cigars they smoked. Respondents who never smoked were coded as never-smokers (reference category). Respondents who indicated that they used to smoke but had quit, were coded as former smokers. Respondents who indicated that they smoke pipe or cigars and respondents who reported to smoke less than 20 cigarettes a day were coded as moderate smokers. Respondents who indicated that they smoked more than 20 cigarettes a day were coded as heavy smokers.

Partner status. Men living with and without a partner were distinguished. In separate

analyses we tested whether the inclusion of marital status provided a better explanation of mortality than partner status alone, but this was not the case.

We included the number of chronic health illnesses, a potentially confounding factor, to account for health status at the time of interview. *Number of chronic conditions* was the number of chronicle conditions respondents report to have (had). They include asthma, myocardial infarction, high blood pressure, stroke, ulcer, gallstones, severe abdominal disorders, kidney stones, severe kidney diseases, prostate enlargements, diabetes, hernia, Ischia, arthrosis, rheumatism, Parkinson, multiple sclerosis, epilepsy, migraine, depression, cancer, chronic skin disease, prolapses, and varicose vains. Because of the low number of respondents who indicated suffering from four or more chronic diseases, respondents with three or more chronic conditions were combined.

Finally, we included men's age, as mortality risks increase significantly with increasing age. *Age* was measured in years.

Preliminary statistical analyses

Occupational class and educational attainment are both indicators of socioeconomic position. Correlation between the two indicators might be high, giving rise to concerns about multicollinearity. Preliminary analyses revealed a correlation of 0.57. To avoid multicollinearity and to examine non-linear effects of educational attainment on mortality, we used a set of dummy variables. Correlations between the different educational levels and occupational class did not go beyond 0.44 (the correlation between occupational class and high level of education), removing concerns about multicollinearity. Therefore, educational attainment and occupational class can be entered simultaneously in the model.

Preliminary analyses also revealed that age had a non-linear effect on mortality risks.

Therefore, we introduced age as a set of dummy variables. The youngest age group (45-50) is the reference category.

Primary statistical analyses

Cox proportional hazard regression models that account for censoring were used to assess the relationship between parity and mortality. Several models were calculated. The base model (Model 1) included parity, the five age-group dummies, and chronic health conditions. Model 2 through Model 5 incorporated different blocks of explanatory variables to test specific mechanisms. SEP (occupational class and educational attainment) was added in Model 2, health behaviors (smoking and drinking) were added in Model 3, and partner status was added in Model 4. The final model, Model 5, incorporated all blocks of variables.

Results

Table 1 shows the distribution of the variables in our models by parity. Childless men appear to be worst off: they have the lowest occupational class (a characteristic they share with the one child fathers), the highest percentages of heavy drinkers and smokers, the fewest partnered men, and the highest percentage with only primary school. Table 2 shows the impact of parity on men's mortality risks, and the predictors underlying this association. The base model shows that fathers with two or three children (HR 0.85; 95 % CI 0.74-0.99) and especially fathers with four or more children (HR 0.81; 95 % CI 0.69-0.95) have lower mortality risks in comparison to childless men (the reference category). Occupational class is not significantly associated with men's mortality risks. Educational attainment is, however, significantly associated with mortality risks: compared to men who have finished primary school only, men with higher levels of education have significantly lower mortality risks (Model 2). With the inclusion of SEP, the

impact of parity on men's mortality risks becomes non-significant. Results show that men who do not drink alcohol and heavy alcohol drinkers have higher mortality risks compared to men who are considered light drinkers. Furthermore, the more men smoke, the higher their mortality risks. A comparison of Model 1 and Model 3 shows that with the inclusion of information on men's health behaviors, the impact of parity on men's mortality risks becomes insignificant. Living with a partner significantly lowers men's mortality risks (HR 0.74; 95 % CI 0.65-0.85). A comparison of Model 1 and Model 4 shows that with the inclusion of this factor, the impact of parity on men's mortality risks is reduced to insignificance. . Not surprisingly, given the previous results, when all the variables are included in the full model, parity no longer has a significant impact on men's mortality risks.

Discussion

We used survey data linked with registry data from the Netherlands to examine the relationship between parity and men's mortality risks. Fathers of two or more children have lower mortality risks than childless men. The mortality risks of fathers of one child and childless men do not differ.

We aimed at identifying mechanisms underlying the relationship between parity and mortality. The results revealed that, once information on men's health behaviors, partner status and SEP had been taken into account, the benefits of having two or more children in terms of lower mortality risks disappeared. Apparently, childless men have higher mortality risks because they miss out on the (indirect) encouragement provided by children and a partner to follow good health practices[16]. As shown in previous research, fathers are less often smokers, drink less and engage more in physical exercise in comparison to childless men[9]. The findings on SEP, in particular educational attainment, suggest that selection into fatherhood plays a role. Childless

men are overrepresented among those with only primary education, making them not only less attractive as potential parents but also more likely to suffer health disadvantages.

We did not observe differences in mortality risks between childless men on the one hand and fathers of one child on the other. In line with evolutionary models, our results suggest that the number of children rather than making the transition to parenthood per se matters for men's mortality. In line with previous studies[17], we found that fathers with one child differ from fathers of multiple children: they come from low occupational classes and have low levels of educational attainment. Future research would benefit from examining in more detail why fathers of one child miss out on the long-term health benefits that fathers of multiple children do reap. However, the non-siginificance of the difference in mortality risks between childless men and fathers of one child might be a methodological issue, related to our small sample sizes, rather than a theoretical one. Small sample sizes lead to less statistical power, meaning a lowered probability that tests will find statistically significant differences. We cannot rule out the possibility that we may have underestimated the true impact of having made the transition to fatherhood on men's mortality risks.

Against the backdrop of increases in unmarried cohabitation and rising divorce rates, the impact of partner status deserves further attention. Our results showed that sharing a household with a partner is protective for mortality. In general, men without a partner display poorer health behaviors and have increased mortality risks[18]. With more and more relationship dissolutions, policies that aim to enhance healthy behaviors among childless and unpartnered men should be welcomed. In our sample we were unfortunately unable to separate the impact of marriage from cohabitation on men's mortality risks. With more and more individuals deciding to live together outside of marriage, it is of interest to see whether living in different union types differentially

impacts men's mortality risks. Understanding family influences on health has the potential to identify opportunities and guide actions that can improve health in later life[19].

This study has its limitations. First of all, it was not possible to disentangle selection effects from adaptation effects. The results reveal that, besides partner status and educational attainment, health behaviors explain the relationship between parity and men's mortality risks. Based on previous research we argued that the transition to parenthood boosts healthy behaviors. However, the data did not enable us to examine the possibility that fathers, even before they became parents, were already engaging in more healthy behavior than childless men, and that their healthy behaviors not only selected them into parenthood but also lowered their mortality risks. Regardless of whether the healthier behavior of fathers is based on selection or adaptation, the findings show that this behavior leads these fathers to have lower mortality risks compared to childless men.

A second limitation of this study is that it was not possible to separate biological parenthood from step-parenthood in the analyses. Given that the prevalence of stepfathers among the men in the sample (born between 1916 and 1946) was quite low, the implications of this limitation for our conclusions are likely to be small. Nevertheless, answering the question of whether the impact of parity on men's mortality risks is different for fathers who have social or biological ties to their children is becoming more relevant, as the number of stepfamilies has substantially increased in recent decades.

The third limitation of this study is the lack of information on paternal co-residence throughout the child's life. Research has shown that living with one's children is protective against premature mortality[20]. Fathers who never actively fathered their children have a higher likelihood of dying young, implying that in our sample, fathers who ever lived with their

children are overrepresented. Given their lower mortality risks, the differences between childless men and fathers found in this study may be overestimated. The literature would benefit from studies including information on residence with children throughout the children's lives.

In conclusion, childless men show an increased risk of mortality over a follow-up period of 17 years. Health behaviors, partner status and educational attainment mediate the relationship between parity and mortality risks among men. This study provides evidence that men's reproductive patterns have long-term health implications.

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Conflicts of interests None declared.

Key points

- Several studies have reported an inverse association or U-shaped pattern between parity and mortality among women. Few studies are available on the association between parity and mortality among men, and underlying mechanisms of a potential association are unclear.
- This study explores the association between parity and all cause mortality among Dutch adult men, and investigates potential mechanisms underlying this association.
- Fathers of two and three children and especially fathers of four and more children are found to have lower mortality risks compared to childless men. Health behaviors, partner status and SEP mediate the relationship between men's parity and their mortality risks.

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Table 1 Distribution of the Samples by Variables used in the Analysis of Parity and Mortality

	childless	1 child	2-3 children	4+ children
No of persons (%)	596 (12%)	596 (12%)	2879 (58%)	894 (18%)
Age-group				
45-50	28%	26%	28%	6%
51-55	17%	20%	22%	11%
56-60	18%	20%	20%	19%
61-65	17%	15%	14%	25%
66-70	14%	14%	11%	26%
71-75	7%	6%	5%	13%
Average number of chronic conditions [a] (SD)	0.81 (0.04)	0.83 (0.04)	0.79 (0.02)	0.83 (0.03)
Occupational class [b]	2.21	2.21	2.74	2.56
Education [c]				
Only primary school	35%	32%	21%	29%
Low level of education	27%	36%	34%	33%
Medium level of education	19%	21%	21%	17%
High level of education	18%	11%	25%	21%
Drinking [d]				
Total abstainer	22%	17%	12%	20%
Light drinker	33%	39%	42%	40%
Moderate drinker	24%	26%	27%	24%

Heavy drinker	21%	18%	18%	16%
Smoking [e]				
Never-smoker	15%	9%	11%	10%
Former smoker	40%	48%	49%	50%
Moderate smoker	35%	34%	31%	34%
Heavy smoker	10%	8%	8%	6%
Lives with partner	61%	90%	94%	89%
Mean age	58	57	56	63
No of deaths (%)	192 (32%)	178 (30%)	820 (28%)	361 (40%)

[a] Number of chronic conditions include asthma, myocardial infarction, high blood pressure, stroke, ulcer, gallstones, severe abdominal disorders, kidney stones, severe kidney diseases, prostate enlargements, diabetes, hernia, Ischia, arthrosis, rheumatism, Parkinson, multiple sclerosis, epilepsy, migraine, depression, cancer, chronic skin disease, prolapses, and varicose veins.

[b] Ranges from 1 (manual unskilled workers) up to 6 (higher professionals and managers)

[c] Respondents were coded as having a low level of education when they have finished lower vocational or lower general secondary education only. Respondents were coded as having a medium level of education when they have finished intermediate general secondary education or upper general secondary education only. Finally, respondents were coded as having a high level of education when they have finished higher vocational education or university.

[d] Respondents were coded as total abstainers when they reported to never consume alcohol. Respondents were coded as light drinkers when they consumed six or more alcoholic beverages once a week, four to five alcoholic beverages twice a week, two to three alcoholic beverages three

times a week or one alcoholic beverage every day of the week. Respondents were coded as moderate drinkers when they consumed six or more alcoholic beverages twice a week, four to five alcoholic beverages three or four days a week, or two to three alcoholic beverages four or more days a week. Respondents were coded as heavy drinkers when they consumed six alcoholic beverages on more than three days a week, or when they consumed four to five alcoholic beverages on five or more days a week.

[e] Respondents who never smoked were coded as never-smokers. Respondents who indicated that they used to smoke but had quit, were coded as former smokers. Respondents who indicated that they smoke pipe or cigars and respondents who reported to smoke less than 20 cigarettes a day were coded as moderate smokers. Respondents who indicated that they smoked more than 20 cigarettes a day were coded as heavy smokers..

Table 2 Hazard Rate Ratio of Parity and Social and Behavioral Factors on Mortality Risks of Men (*n* = 4965, Person-Months = 858914, Deaths = 1551)

	Base Model		M 2		M 3		M 4		Full model	
	HR ratio	CI	HR ratio	CI	HR ratio	CI	HR ratio	CI	HR ratio	CI
Parity [a]										
1 child	0.89	0.75-1.08	0.88	0.72-1.07	0.90	0.74-1.08	0.97	0.80-1.18	0.94	0.77-1.18
2-3 children	0.85*	0.74-0.99	0.92	0.79-1.07	0.92	0.79-1.06	0.95	0.82-1.10	1.02	0.87-1.20
4 + children	0.81**	0.69-0.95	0.88	0.74-1.05	0.85	0.72-1.00	0.89	0.75-1.05	0.94	0.78-1.13
Age groups [b]										
51-55	1.56***	1.24-2.01	1.61***	1.27-2.06	1.71***	1.35-2.17	1.62***	1.28-2.06	1.84***	1.43-2.36
56-60	3.38***	2.75-4.16	3.40***	2.74-4.21	3.52***	2.86-4.34	3.38***	2.73-4.18	3.63***	2.90-4.53
61-65	5.76***	4.71-7.05	5.69***	4.61-7.03	6.13***	5.00-7.53	5.87***	4.79-7.20	6.28***	5.05-7.81
66-70	9.02***	7.41-10.99	9.13***	7.42-11.25	9.93***	8.11-12.17	9.08***	7.43-10.09	10.05***	8.08-12.49
71-75	12.89***	10.43-15.93	13.75***	10.99-17.20	14.62***	11.77-18.15	12.81***	10.32-15.88	14.31***	11.33-18.06
Chronic conditions [c]	1.18***	1.13-1.23	1.21***	1.15-1.28	1.21***	1.15-1.26	1.18***	1.13-1.24	1.22***	1.17-1.29

Occ. class [d]		0.97	0.93-1.00				0.99	0.95-1.03
Education [e]								
Low education		0.80***	0.70-0.91				0.84**	0.73-0.96
Medium education		0.81**	0.70-0.95				0.87	0.73-1.02
High education		0.63***	0.52-0.75				0.68***	0.56-0.82
Drinking [f]								
Total abstainer				1.34***	1.18-1.53		1.28***	1.11-1.47
Moderate drinker				0.96	0.84-1.08		0.97	0.84-1.11
Heavy drinker				1.30***	1.14-1.49		1.22***	1.06-1.42
Smoking [g]								
Former smoker				1.50***	1.22-1.84		1.56***	1.25-1.95
Moderate smoker				2.57***	2.09-3.15		2.65***	2.12-3.31
Heavy smoker				3.30***	2.58-4.22		3.29***	2.51-4.31
Lives with partner						0.74***	0.78***	0.67-0.91
Log likelihood	-14548	-12860		-13893		-14114	-12204	

Note * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$. 95 % confidence intervals in parentheses.

[a] Reference category is childless.

[b] Reference category is 45-50.

[c] Number of chronic conditions include asthma, myocardial infarction, high blood pressure, stroke, ulcer, gallstones, severe abdominal disorders, kidney stones, severe kidney diseases, prostate enlargements, diabetes, hernia, Ischia, arthrosis, rheumatism, Parkinson, multiple sclerosis, epilepsy, migraine, depression, cancer, chronic skin disease, prolapses, and varicose veins.

[d] Occupational class ranges from 1 (manual unskilled workers) up to 6 (higher professionals and managers)

[e] Respondents were coded as having a low level of education when they have finished lower vocational or lower general secondary education only. Respondents were coded as having a medium level of education when they have finished intermediate general secondary education or upper general secondary education only. Finally, respondents were coded as having a high level of education when they have finished higher vocational education or university. Reference category is only primary education.

[f] Respondents were coded as total abstainers when they reported to never consume alcohol. Respondents were coded as light drinkers when they consumed six or more alcoholic beverages once a week, four to five alcoholic beverages twice a week, two to three alcoholic beverages three times a week or one alcoholic beverage every day of the week. Respondents were coded as moderate drinkers when they consumed six or more alcoholic beverages twice a week, four to five alcoholic beverages three or four days a week, or two to three alcoholic beverages four or more days a week. Respondents were coded as heavy drinkers when they consumed six alcoholic beverages on more than three days a week, or when they consumed four to five alcoholic beverages on five or more days a week. Reference category is light drinkers.

[g] Respondents who never smoked were coded as never-smokers. Respondents who indicated that they used to smoke but had quit, were coded as former smokers. Respondents who indicated that they smoke pipe or cigars and respondents who reported to smoke less than 20 cigarettes a day

were coded as moderate smokers. Respondents who indicated that they smoked more than 20 cigarettes a day were coded as heavy smokers.

Reference category is never smoker.