

Does losing a parent early influence the education you obtain? A nationwide cohort study in Denmark

B.L. Høeg¹, C. Johansen^{1,2}, J. Christensen³, K. Frederiksen³, S. Oksbjerg Dalton¹, P. Bøge⁴, A. Dencker⁴, A. Dyregrov⁵, P.E. Bidstrup¹

¹Survivorship Unit, Danish Cancer Society Research Center, Strandboulevarden 49, 2100 Copenhagen, Denmark

²Department of Oncology, Copenhagen University Hospital, Rigshospitalet, 2100 Copenhagen, Denmark

³Statistics, Bioinformatics and Registry Unit, Danish Cancer Society Research Center, 2100 Copenhagen, Denmark

⁴Department of Patient Support and Community Activities, Danish Cancer Society, 2100 Copenhagen, Denmark

⁵Center for Crisis Psychology, Bergen, Norway

Address correspondence to Beverley Lim Høeg, E-mail: bevlim@cancer.dk

ABSTRACT

Background Health inequalities are rooted in education and we investigate the association between early parental death and attainment across the educational spectrum.

Methods Using total population data on Danes born between 1982 and 2000 ($n = 1\,043\,813$), we assess incidence rate ratios (RRs) by gender for attainment of each educational level (basic school, high school or vocational training, bachelor degree or professional programme, and university graduate degree) according to loss of a parent before the age of 18 years. We adjust for family income, education and psychiatric illness and examine parent's gender, cause of death and child's age at time of death as potential moderators.

Results Bereaved people had significantly lower attainment rates than non-bereaved people: basic school (RR = 0.95; 95% CI: 0.93–0.97 for men and 0.96; 0.94–0.98 for women), high school or vocational training (0.78; 0.76–0.80 for men and 0.82; 0.80–0.84 for women), bachelor degree or professional programme (0.74; 0.70–0.79 for men and 0.83; 0.79–0.86 for women) and university graduate degree (0.77; 0.68–0.86 for men and 0.77; 0.69–0.86 for women). Parent's gender, cause of death and child's age at the death did not modify the associations.

Conclusions As education impacts population health, support for bereaved school children may be more important than realized.

Keywords children, education, employment and skills, epidemiology

Introduction

Education has a profound impact on population health, as success in the classroom predicts income and health behaviours, which subsequently influence not only physical and psychological morbidity but also, ultimately, mortality.¹ An estimated 5% of children in Western countries experience parental death before they reach adulthood² and research has shown that early parental death could have deleterious consequences for educational outcomes. For example, a 2014 cohort study in Sweden of 772 117 people showed that those who had been bereaved as children had up to twice the odds of failing basic school as those who had not.³ This problem warrants attention because of the strong link between education and health. Disparities in vulnerability to

disease also have social consequences, which create health inequalities that can be passed on to the next generation.^{4,5}

While education comprises many levels, most studies have not taken a life-course perspective and have focused only on fragmented aspects of education, with outcomes ranging

B.L. Høeg, PhD Student

C. Johansen, Professor in Cancer Late Effects and Unit Leader

J. Christensen, Statistician

K. Frederiksen, Senior Statistician

S. Oksbjerg Dalton, Senior Researcher

P. Bøge, Teacher

A. Dencker, PhD Student

A. Dyregrov, Professor of Psychology and Head of professional issues

P.E. Bidstrup, Senior Researcher

from exam grades to enrolment in school.^{3,6–10} Furthermore, some studies addressed only paternal deaths,^{11,12} or were cross-sectional or based on self-reported survey data,^{7–10} which may potentially be biased. The roles of factors such as the deceased parent's gender, cause of death and the child's age at the time of the death are also not well studied. This knowledge is important because it can help identify potentially vulnerable sub-groups of children. For example, younger children who experience parental death may be more vulnerable than older children because of their early stage of cognitive development and limited capacity to cope with grief.¹³ Children who have lost to suicide may also be more severely affected because of the social stigma that often follows, which may complicate the grieving process and affect the support available to the grieving child from surrounding social environment.¹⁴ Finally, many studies were conducted in countries where education requires financial resources^{7,8,12} and the financial effect of parental death might obscure the study of other factors that potentially link the loss to educational outcomes. In summary, there is a gap in the literature regarding the association between early parental death and long-term educational attainment, with consistent measures at each level over time, to facilitate comparison and understanding of this important area.

In this study, we investigate the association between early parental death and attaining a specific level of education, from basic school to university graduate studies. The Danish educational system is publically funded up to university level, and since 1970, all students over the age of 18 years can apply for a monthly allowance, which minimizes the economic effect on educational attainment. This provides a unique opportunity to disentangle economic factors from other loss-related factors in investigating our objective. We studied males and females separately, as educational outcomes traditionally differ by gender,¹⁵ and investigated the parent's gender, cause of death and the child's age at time of the death as potential moderators. In the context of free education, we hypothesized moderate effects of early parental death on attainment, where the role of the identified moderators will be especially apparent.

Methods

Study population

We conducted a nationwide registry-based cohort study. All residents of Denmark have been recorded in the Central Population Register (CPR) since 1 April 1968¹⁶ with a unique personal identification number that ensures accurate linkage of information among all national registries. As the Danish Education Registry was first started in 1981,¹⁷ we

defined a study population that comprised all people born in Denmark between 1 January 1982 and 31 December 2000 whose parents could be identified at the time of their birth. From the CPR, we extracted information on gender, dates of birth, migration and death and family relationships. Parent-child links were identified through the Danish Fertility Database,¹⁸ which has complete information on the parents of all children born after 1960.

We identified 1 238 740 children and their parents. We followed only those who were alive and living in Denmark and for each level of analysis, the following numbers were eligible: basic school, $n = 1\,133\,356$; high school or vocational training, $n = 919\,595$; bachelor degree or professional programme, $n = 771\,166$; and university graduate degree, $n = 612\,589$. Due to missing values for parental variables, we had to exclude the following numbers of children: 89 543 (basic school), 73 296 (high school or vocational training), 60 617 (bachelor degree or professional programme) and 48 104 (university graduate degree). Thus, in total, we followed 1 043 813 people for attained compulsory school, 846 299 for attained high school or vocational training, 710 549 for attained bachelor degree or professional programme and 564 485 for attained university graduate degree.

The study protocol was approved by the Danish Data Protection Agency (J.nr. 2009-41-3506). Ethics approval was not required, as the study was based on anonymised registers, and we did not use human blood or tissue samples.

Parental death

We obtained the causes of death of parents from the Danish Register of Cause of Death, which contains information on all deaths since 1970.¹⁹ We categorized cause of death by the World Health Organization's International Classification of Diseases (ICD-10) codes for suicide (X60-X84, Y870) and for all other causes.²⁰ We chose to focus on suicide because suicide have been shown to be distinct from other causes of death¹⁴ and may indicate a family who is psychosocially vulnerable pre-death and has been linked to worse health and well-being outcomes.^{21,22}

Educational attainment

Education in Denmark is free, except for books and certain administrative fees at tertiary level, and the Danish student grants and loans scheme allows all students over the age of 18 to apply for a monthly allowance.²³ The scheme was started in 1970, as part of a socio-democratic policy to ensure equal access to education regardless of financial background. The highest pre-tax monthly allowance is currently DKK 5941 (approximately GBP 680) for tertiary-level

students who do not live at home.²³ We linked information on the study population and their parents to the Danish Education Registry, which contains individual information about all educational programmes in the country since 1981.¹⁷ We obtained information on type and level of education, whether it was completed and the year of completion. Parental education, which may be a confounder, was defined as the highest educational level of either parent and was obtained for the year before the birth of the child. The Danish educational system comprises 10 years of compulsory basic school (primary and lower secondary education for children aged 6–15 years), upper secondary education (high school or vocational or technical training) and tertiary education (consisting of 3–3.5-year bachelor degree or professional programmes and graduate Masters and PhD university programmes).²⁴ We grouped educational level into four categories corresponding to the International Standard Classification of Education (ISCED-2011) codes: basic school (codes 1–2), high school or vocational training (3–4), bachelor degree or professional programme (5–6) and university graduate degree (7–8).²⁵

Covariates

Parental education, income and psychiatric illness were identified as potential confounders as family socioeconomic and psychiatric factors have been linked to both early parental death and child educational outcomes.^{22,26} Information on parental education, income and psychiatric illness was obtained for the year before the birth of the child from the Danish Education Register,¹⁷ Danish Income Statistics Register,²⁷ the National Prescription Registry²⁸ and the Central Psychiatric Register.²⁹ We used the highest attained education level of either parent. Disposable household income per person was categorized as low (first quartile), middle (second and third quartiles) or high (fourth quartile), calculated in Danish kroner after taxation and adjusted for the number of people in the household and for inflation with the year 2000 as reference. Psychiatric illness was defined as first psychiatric hospitalization, outpatient treatment or use of antidepressants by either parent. We obtained information on all psycho-pharmaceutical prescriptions corresponding to Anatomical Therapeutic Chemical (ATC) code N06A for antidepressants³⁰ and on hospital admissions for diagnoses related to all psychiatric disorders, court-ordered psychiatric treatment, substance use and suicide attempts. Information on education and income was available from 1981, on psychiatric hospitalization from 1969, and on antidepressant use and outpatient psychiatric treatment only from 1995.

Statistical analyses

For each educational level, we calculated person-years at risk from the year before the minimum possible age of attaining that specific level: age of 13 years for compulsory basic school, 16 years for high school or vocational training, 18 years for bachelor degree or professional programme and 20 years for university graduate degree. Exposure was defined as parental death before age 18 or age at entry, whichever came first. All people were followed until the first year in which they attained the investigated level of education, death, emigration or 31 December 2013, which was the end of the study period.

The absolute level of educational attainment for all four levels in the study population and the cumulative probability of attaining the associated level before a given age was estimated non-parametrically according to gender and exposure status, taking into account competing risk from child's death using the Aalen Johansen estimator³¹ calculated with Cuminc SAS macro.³² Exposure was defined as parental death before age 18 or age at entry, whichever came first.

Incidence rate ratios (RRs) for educational attainment according to early parental death with 95% confidence intervals (CIs) were estimated in multiplicative Poisson models. We performed separate analyses for men and women. Person-time was stratified according to exposure status into two groups (parental death and no parental death), attained age into six groups (<20, 20–24, 25–29 and ≥30 years) and calendar periods into five groups (1988–92, 1993–97, 1998–2002, 2003–7 and 2008–13) in order to adjust for potential confounding from current age and calendar period with changes in the monthly allowance and admission requirements over time. In the analyses for basic school, the groups of attained age were <15, 15–19, 20–24, 25–29 and ≥30 years. Models were fitted with and without adjustment for parental education, income and psychiatric illness at the time of the child's birth.

To determine whether associations between parental death and educational attainment were moderated by which parent was lost, cause of death (suicide or other) and age at time of the loss (0–5, 6–11, 12–17 years), we fitted models that allowed interaction between exposure and each of the three factors, providing parameter estimates in each group. *P* values for no moderation of the effect measure were calculated in likelihood ratio tests.

Results

The crude estimated proportions of bereaved and non-bereaved people who completed each level of education showed that those who had been bereaved versus those who

had not been bereaved differed only slightly in completing basic school (Fig. 1). For the other educational levels, however, bereaved men and women had consistently lower rates of attainment than non-bereaved people. The rates of attainment dropped as the level of education increased in both the bereaved and non-bereaved populations, with men having overall lower rates of attainment than women.

RRs for attainment of each educational level are presented by gender in Tables 1–4. In comparison with non-bereaved people, those who had been bereaved were less likely to finish compulsory school (RR = 0.95, 95% CI: 0.93–0.97 for men; RR = 0.96, 95% CI: 0.94–0.98 for women), high school or vocational training (RR = 0.78, 95% CI: 0.76–0.80 for men; RR = 0.82, 95% CI: 0.80–0.84 for women), bachelor degree or professional programme (RR = 0.74, 95% CI: 0.70–0.79 for men; RR = 0.83, 95% CI: 0.79–0.86 for women) and university graduate degree (RR = 0.77, 95% CI: 0.68–0.86 for men; RR = 0.77, 95% CI: 0.69–0.86 for

women). At all levels, neither the gender of the deceased parent, cause of death nor the child's age at time of the death were found to modify our results. The only exception was completion of a bachelor degree or professional programme by women, wherein those who experienced the loss of a parent at or below the age of 5 years or between the ages of 13–17 years fared worse than those who experienced the loss between the ages of 6 and 12 years ($P = 0.04$).

Discussion

Main findings of this study

This is the first study to investigate the association between early parental death and attaining a specific level of education across the educational spectrum, from basic school and into university graduate studies. We found that early parental death may have long-term implications for educational attainment, regardless of the level of education,

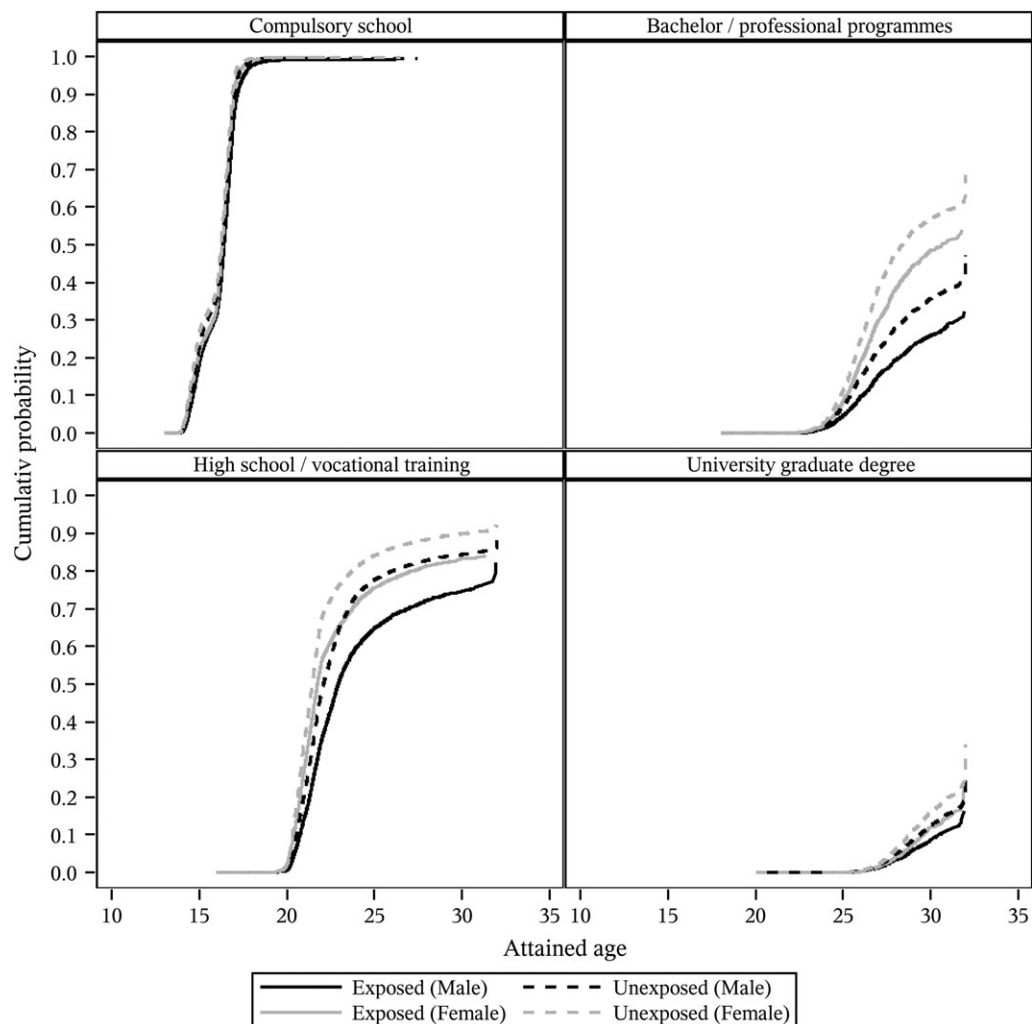


Fig. 1 Proportions of boys and girls who complete each educational level by age and bereavement status in the study population.

Table 1 Rate ratios (RRs) and their 95% confidence intervals (CIs) for attaining basic school according to bereavement status (N = 1 043 813)

	Men					P	Women					P
	N attained	RR ^a	CI	RR ^b	CI		N attained	RR ^a	CI	RR ^b	CI	
Attained												
Bereaved	10 907	0.94	0.92–0.96	0.95	0.93–0.97		10 792	0.96	0.94–0.97	0.96	0.94–0.98	
Not bereaved	468 025	1.00	–	1.00	–		454 419	1.00	–	1.00	–	
Cause of parent's death												
Suicide	1281	0.94	0.89–1.00	0.96	0.90–1.00	0.84	1277	0.94	0.89–0.99	0.94	0.89–0.99	0.42
Other	9626	0.94	0.92–0.96	0.95	0.93–0.97		9515	0.96	0.94–0.98	0.96	0.94–0.98	
Not bereaved	468 025	1.00	–	1.00	–		454 419	1.00	–	1.00	–	
Parent who died												
Father	7656	0.94	0.91–0.96	0.95	0.93–0.97	1.00	7681	0.95	0.93–0.97	0.96	0.94–0.98	0.95
Mother	3251	0.94	0.91–0.98	0.95	0.92–0.98		3111	0.96	0.93–1.00	0.96	0.93–1.00	
Not bereaved	468 025	1.00	–	1.00	–		454 419	1.00	–	1.00	–	
Age at parent's death (years)												
≤5 years	3668	0.93	0.90–0.96	0.94	0.91–0.97	0.57	3559	0.96	0.93–1.00	0.97	0.94–1.00	0.44
6–12 years	7239	0.94	0.92–0.96	0.95	0.93–0.98		7233	0.95	0.93–0.97	0.96	0.93–0.98	
13–17 years	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	
Not bereaved	468 025	1.00	–	1.00	–		454 419	1.00	–	1.00	–	

^aAdjusted for age and calendar year.
^bFurther adjusted for family income, education and psychiatric illness (at birth).

which parent died, the cause of death or the child's age at the time. We also found that as the level of education became higher, the differences in attainment between the bereaved and non-bereaved increased in both genders, with up to a 26% lowered rate of attaining a bachelor or professional degree among bereaved males when compared to non-bereaved males. These results remained even after adjustment for potential confounders including family socio-economic status and psychiatric illness in the family. Our results emphasizes the importance of studying education in a life-course perspective, as previous studies only studied specific fragmented aspects of education in adult life.

What is already known

Parental death was found previously to affect certain educational outcomes largely through family income and socio-economic status,^{7,15} and a study in Sweden found that differences in mean grades in compulsory basic school disappeared after adjustment for economic and psychosocial factors.³ Little is known about the potential moderating effects of parent gender, cause of death and child's age at time of death on educational outcomes, although some previous studies have shown that maternal death has a greater effect on cognitive skills and socio-emotional development

than paternal death, which may be expected to negatively affect educational attainment.^{6,33}

What this study adds

While the finding from the above-mentioned Swedish study may be comparable to our finding of only a 4–5% difference in completion of basic school between bereaved and non-bereaved people, our results on subsequent attainment of higher education by gender showed up to a 26% lowered rate among bereaved males. This indicates a possible accumulation of effects over time stemming from academic and social vulnerabilities arising after the loss, and points towards the need for interventions that are not just grief-based, but also school-based. Furthermore, we did not find a moderating effect of the gender of the deceased parent on educational attainment. Our findings may indicate equalization of parental roles in younger generations, with fathers and mothers playing equally important roles in nurturing their child's cognitive development. It is unclear why the cause of death and the child's age at time of the death did not appear to moderate educational attainment, as suggested previously. We can only conclude that experiencing the death of a parent has long-term effects on educational attainment, regardless of how and when the loss occurred.

Table 2 Rate ratios (RRs) and their 95% confidence intervals (CIs) for attaining high school/vocational training according to bereavement status (*N* = 846 299)

	<i>Men</i>					<i>P</i>	<i>Women</i>					<i>P</i>
	<i>N attained</i>	<i>RR^a</i>	<i>CI</i>	<i>RR^b</i>	<i>CI</i>		<i>N attained</i>	<i>RR^a</i>	<i>CI</i>	<i>RR^b</i>	<i>CI</i>	
Attained												
Bereaved	5649	0.70	0.68–0.72	0.78	0.76–0.80		5970	0.75	0.73–0.77	0.82	0.80–0.84	
Not bereaved	194 031	1.00	–	1.00	–		190 904	1.00	–	1.00	–	
Cause of parent's death												
Suicide	611	0.71	0.65–0.77	0.79	0.73–0.86	0.59	646	0.75	0.69–0.81	0.82	0.76–0.88	0.93
Other	5038	0.70	0.68–0.72	0.78	0.75–0.80		5324	0.75	0.73–0.77	0.82	0.80–0.84	
Not bereaved	194 031	1.00	–	1.00	–		190 904	1.00	–	1.00	–	
Parent who died												
Father	3914	0.69	0.67–0.71	0.78	0.76–0.80	0.82	4210	0.74	0.72–0.76	0.83	0.80–0.85	0.21
Mother	1735	0.73	0.70–0.76	0.77	0.74–0.81		1760	0.76	0.73–0.80	0.80	0.76–0.84	
Not bereaved	194 031	1.00	–	1.00	–		190 904	1.00	–	1.00	–	
Age at parent's death (years)												
≤5 years	1288	0.68	0.64–0.72	0.77	0.72–0.81	0.67	1339	0.71	0.67–0.74	0.80	0.76–0.84	0.14
6–12 years	2654	0.71	0.68–0.74	0.79	0.76–0.82		2885	0.77	0.74–0.80	0.84	0.81–0.87	
13–17 years	1707	0.71	0.68–0.75	0.77	0.74–0.81		1746	0.75	0.72–0.79	0.80	0.76–0.84	
Not bereaved	194 031	1.00	–	1.00	–		190 904	1.00	–	1.00	–	

^aAdjusted for age and calendar year.^bFurther adjusted for family income, education and psychiatric illness (at birth).**Table 3** Rate ratios (RRs) and their 95% confidence intervals (CIs) for attaining bachelor/professional programmes according to bereavement status (*N* = 710 549)

	<i>Men</i>					<i>P</i>	<i>Women</i>					<i>P</i>
	<i>N attained</i>	<i>RR^a</i>	<i>CI</i>	<i>RR^b</i>	<i>CI</i>		<i>N attained</i>	<i>RR^a</i>	<i>CI</i>	<i>RR^b</i>	<i>CI</i>	
Attained												
Bereaved	1271	0.68	0.64–0.72	0.74	0.70–0.79		1983	0.76	0.73–0.80	0.83	0.79–0.86	
Not bereaved	39 334	1.00	–	1.00	–		53 791	1.00	–	1.00	–	
Cause of parent's death												
Suicide	142	0.76	0.64–0.90	0.86	0.73–1.01	0.07	215	0.78	0.68–0.89	0.82	0.72–0.94	0.95
Other	1129	0.67	0.63–0.71	0.73	0.69–0.78		1768	0.76	0.73–0.80	0.83	0.79–0.87	
Not bereaved	39 334	1.00	–	1.00	–		53 791	1.00	–	1.00	–	
Parent who died												
Father	849	0.64	0.60–0.69	0.72	0.67–0.77	0.09	1349	0.73	0.69–0.77	0.81	0.77–0.85	0.15
Mother	422	0.76	0.69–0.83	0.80	0.72–0.88		634	0.84	0.78–0.91	0.87	0.80–0.94	
Not bereaved	39 334	1.00	–	1.00	–		53 791	1.00	–	1.00	–	
Age at parent's death (years)												
≤ 5 years	229	0.66	0.58–0.76	0.74	0.65–0.85	0.99	351	0.72	0.64–0.79	0.79	0.71–0.88	0.04
6–12 years	471	0.67	0.61–0.73	0.74	0.67–0.81		808	0.81	0.75–0.87	0.89	0.83–0.95	
13–17 years	571	0.69	0.63–0.75	0.75	0.69–0.81		824	0.74	0.69–0.80	0.79	0.74–0.85	
Not bereaved	39 334	1.00	–	1.00	–		53 791	1.00	–	1.00	–	

^aAdjusted for age and calendar year.^bFurther adjusted for family income, education and psychiatric illness (at birth).

Table 4 Rate ratios (RRs) and their 95% confidence intervals (CIs) for attaining graduate university (*N* = 564 485)

	Men					P	Women					P
	N attained	RR ^a	CI	RR ^b	CI		N attained	RR ^a	CI	RR ^b	CI	
Attained												
Bereaved	312	0.70	0.62–0.78	0.77	0.68–0.86		329	0.71	0.64–0.80	0.77	0.69–0.86	
Not bereaved	9577	1.00	–	1.00	–		9897	1.00	–	1.00	–	
Cause of parent's death												
Suicide	38	0.83	0.61–1.14	0.93	0.68–1.28	0.22	45	0.88	0.66–1.18	0.89	0.66–1.19	0.31
Other	274	0.68	0.61–0.77	0.75	0.66–0.84		284	0.69	0.62–0.78	0.75	0.67–0.85	
Not bereaved	9577	1.00	–	1.00	–		9897	1.00	–	1.00	–	
Parent who died												
Father	205	0.66	0.57–0.76	0.74	0.74–0.64	0.32	220	0.68	0.60–0.78	0.77	0.67–0.88	0.91
Mother	107	0.79	0.66–0.96	0.83	0.69–1.00		109	0.78	0.65–0.95	0.78	0.64–0.94	
Not bereaved	9577	1.00	–	1.00	–		9897	1.00	–	1.00	–	
Age at parent's death (years)												
≤5 years	56	0.69	0.53–0.89	0.76	0.59–0.99	0.79	70	0.81	0.64–1.02	0.88	0.70–1.11	0.43
6–12 years	111	0.67	0.55–0.80	0.73	0.61–0.88		125	0.70	0.59–0.84	0.76	0.64–0.91	
13–17 years	145	0.73	0.62–0.86	0.80	0.68–0.94		134	0.68	0.58–0.81	0.73	0.61–0.86	
Not bereaved	9577	1.00	–	1.00	–		9897	1.00	–	1.00	–	

^aAdjusted for age and calendar year.
^bFurther adjusted for family income, education and psychiatric illness (at birth).

Since at least one child out of every 20 will experience parental death and the link between educational attainment and health and well-being is well-established,^{1,34} we cannot ignore the potential impact of early parental death on educational attainment. Interventions need to target the child-related, parent-related and/or school-related mechanisms involved.³⁵ Child-related mechanisms include the impact of grief on the child's cognitive capability, psychosocial well-being, and the potential exacerbation of behavioural problems.^{22,36} Just as important is the role of the parent in nurturing the development of their children, as posited by social cognitive theory and attachment theory.^{37,38} When one parent dies, the surviving parent may be unable to compensate for the loss of parental support and supervision because of extra economic and household responsibilities.³⁹ This may affect the child's development and the parent's involvement in school activities, which are both important predictors of schooling outcomes.⁴⁰ In fact, findings from the Family Bereavement Programme, a 12-session family-based grief intervention, have shown that improved parenting skills mediated the effect of the intervention on academic expectations and GPA.⁴¹ Finally, support at schools for bereaved children need co-ordination, especially in the long-term, when many bereaved children and adolescents finally take in the reality of their loss and begin to struggle, but when teachers may have forgotten about the death.^{2,35}

The present study is methodologically robust, as it drew on a large, virtually complete national population and had a longitudinal design. The use of registry-based data that had been collected independently of the study hypotheses minimized the selection bias inherent in self-reported data and allowed us to adjust for important confounders such as parental income, educational level and psychiatric illness. We also discriminated among sub-groups that have been suggested previously to be especially vulnerable by distinguishing between parent gender and causes of death, and combined it with a developmental approach by taking child's age at the death into account.

Limitations

Potential limitations include possible residual confounding, e.g. from parental education and psychiatric illness, which was obtained only from the year before the birth of the child. Also, due to our study design, which aimed only at establishing whether there was an association between parental death and attaining a specific level of education across time, we are unable to specify whether children do not attain a particular level of education because they did not start it. For a finer-grained perspective, future studies may build on our results by investigating educational attainment only

among those who start a specific level. We are also cautious about the generalizability of our results to populations who live in societies that may differ greatly from that of industrialized countries like Denmark.

Conclusion

The importance of education for health and opportunities cannot be underestimated, as it equips individuals with the skills and knowledge necessary to thrive and contribute to society. Although the Danish educational system supports equal opportunity regardless of financial background, we found that early parental death has deleterious consequences for educational attainment, which may initiate processes that affect life-long well-being. Thus, support for bereaved children may be more important than currently recognized. Scholarships might be valuable in buffering the financial impact of parental death in non-Nordic countries, while interventions that include extra supervision at school, family counselling and mentoring programmes for bereaved students might be developed and evaluated in future studies.

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