Short Lives: The Impact of Parental Death on Early-Life Mortality and Height in the Netherlands, 1850–1940

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Supplementary material

Table S1: Summary statistics split for non-orphaned and orphaned boys

Table S2: Effect of parental death in period in childhood on boys' likelihood of death, Cox proportional hazard survival analysis, birth cohort 1850-1879

Table S3: Effect of parental death in period in childhood on boys' likelihood of death, Cox proportional hazard survival analysis, birth cohort 1880-1899

Table S4: Effect of parental death in period in childhood on boys' likelihood of death, Cox proportional hazard survival analysis, birth cohort 1900-1922

Table S5: Effect of parental death in period in childhood on girls' likelihood of death, Cox proportional hazard survival analysis, birth cohort 1850-1879

Table S6: Effect of parental death in period in childhood on girls' likelihood of death, Cox proportional hazard survival analysis, birth cohort 1880-1899

Table S7: Effect of parental death in period in childhood on girls' likelihood of death, Cox proportional hazard survival analysis, birth cohort 1900-1922

Table S8: Effect of paternal and maternal death and birth order on boys' likelihood of death, interaction models, Cox proportional hazard survival analysis

Table S9: Effect of parental death in childhood on height outcomes of boys in centimeters, by birth cohort, OLS regression model

Table S10: Effect of parental death in period in childhood on height outcomes of boys in centimeters, by birth cohort, by age, OLS regression model

Table S1. Summary statistics split for non-orphaned and orphaned boys

Percentage or mean	Mortality sample		Height sample	
	Boys, Non-orphan	Boys, Orphan	Boys, Non-orphan	Boys, Orphan
Stature at draft in cm (sd)	-	-	169.0 (7.1)	168.3 (7.3)
Control variables				
Birth order (sd)	3.3 (2.2)	4.0 (2.5)	3.1 (2.1)	3.8 (2.4)
Socioeconomic status in %				
Unskilled workers	34.8 (5,343)	35.7 (1,241)	34.2 (1,039)	35.4 (398)
Elite	2.3 (347)	2.3 (79)	1.6 (48)	2.0 (22)
Middle Class	14.7 (2,265)	14.9 (520)	14.4 (437)	13.9 (156)
Skilled Workers	31.2 (4,767)	28.7 (1,000)	31.5 (959)	29.9 (336)
Farmers	12.9 (1,976)	15.6 (542)	15.2 (463)	16.4 (185)
No/unknown	4.3 (666)	2.8 (99)	3.1 (95)	3.1 (28)
Province in %				
Friesland, Groningen, Noord Holland (NW)	30.2 (4,639)	32.9 (1,146)	47.9 (1,456)	47.5 (534)
Drenthe, Overijssel, Gelderland (E)	17.2 (2,638)	18.7 (650)	15.9 (485)	15.9 (179)
Utrecht, Zuid Holland, Zeeland (SW)	36.6 (5,622)	32.9 (1,145)	19.0 (579)	19.0 (214)
Noord-Brabant, Limburg (S)	16.0 (2,465)	15.5 (540)	17.1 (521)	17.5 (197)
Study Birth Cohort				
Birth cohort 1850-1879	31.5 (4,837)	36.4 (1,270)	41.8 (1,272)	50.8 (571)
Birth cohort 1880-1899	36.1 (5,546)	37.2 (1,296)	40.4 (1,229)	37.9 (426)
Birth cohort 1900-1922	32.4 (4,981)	26.3 (915)	17.8 (540)	11.4 (128)
N	15,364	3,481	2,940	1,226

Table S2. Effect of parental death in period in childhood on boys' likelihood of death, Cox proportional hazard survival analysis, birth cohort 1850-1879

	Model 1: Age 0 to 20			Model 2: Age 0 to 20, controlled			Model 3: Age 0 to 1			Model 4: Age 1 to 5			Model 5: Age 5 to 12			Model 6: Age 12 to 20		
	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p
Parental death																		
No death age 0-20	Ref																	
Father dies age 0-20	1.44	1.13-1.85	.004	1.47	1.14-1.88	.002												
Mother dies age 0-20	1.88	1.50-2.35	.000	1.93	1.54-2.41	.000												
No death between 0-1										Ref			Ref			Ref		
Father 0-1							2.13	1.06-4.28	.034	0.63	0.20-1.95	.421	0.78	0.11-5.57	.802	1.95	0.48-2.50	.353
Mother 0-1							5.48	3.86-7.80	.000	1.93	0.91-4.08	.085	0.00	-	.975	0.00	-	.977
No death between 1-5							-			Ref			Ref			Ref		
Father 1-5							-			1.67	0.94-2.97	.081	1.30	0.64-2.66	.466	0.76	0.42-2.52	.957
Mother 1-5							-			2.25	1.34-3.78	.002	1.62	0.85-3.07	.140	1.03	0.28-2.07	.597
No death between 5-12							-			-			Ref			Ref		
Father 5-12							-			-			1.75	0.81-3.76	.153	1.67	0.97-2.86	.064
Mother 5-12							-			-			0.47	0.12-1.91	.293	1.17	0.63-2.16	.625
No death between 12-20																Ref		
Father 12-20																1.73	0.93-3.25	.085
Mother 12-20																1.09	0.48-2.50	.831
Events	2,403			2,403			1,394			664			190			155		
Observations	6,107			6,107			6,107			4,713			4,049			3,859		

Table S3. Effect of parental death in period in childhood on boys' likelihood of death, Cox proportional hazard survival analysis, birth cohort 1880-1899

	Model 1: Age 0 to 20			Model 2: Age 0 to 20, controlled			Model 3: Age 0 to 1			Model 4: Age 1 to 5			Model 5: Age 5 to 12			Model 6: Age 12 to 20		
	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p
Parental death																		
No death age 0-20	Ref																	
Father dies age 0-20	1.71	1.26-2.31	.001	1.73	1.27-2.34	.000												
Mother dies age 0-20	1.94	1.47-2.55	.000	1.95	1.48-2.56	.000												
No death between 0-1							Ref			Ref			Ref			Ref		
Father 0-1							3.41	1.52-7.62	.003	2.23	0.83-6.00	.111	0.00		.989	2.26	0.31-16.31	.420
Mother 0-1							3.28	1.97-5.45	.000	1.34	0.43-4.18	.617	0.00		.988	0.00		.981
No death between 1-5							-			Ref			Ref			Ref		
Father 1-5							-			1.68	0.75-3.79	.208	1.22	0.45-3.31	.697	0.72	0.18-2.91	.641
Mother 1-5							-			2.13	1.00-4.53	.049	2.12	0.99-4.56	.054	1.41	0.52-3.84	.501
No death between 5-12							-			-			Ref			Ref		
Father 5-12							-			-			1.75	0.97-5.12	.058	1.53	1.07-3.55	.030
Mother 5-12							-			-			1.88	0.76-4.64	.172	1.95	0.77-3.03	.224
No death between 12-20																Ref		
Father 12-20																1.21	0.53-2.77	.657
Mother 12-20																1.76	0.81-3.80	.152
Events	2,048			2,048			1,288			491			142			127		
Observations	6,842			6,842			6,842			5,554			5,063			4,921		

Notes: Father/Mother death within age group under analysis are marked in grey; lagged effects are shown above the diagonal (e.g. effect of parental death between age 0-1 in on death child between age 1-5). Effects are hazard rates from proportional hazard Cox models. Models 2-6 control for the effects of socioeconomic status, region, period and death of the other parent as well as death of the parent in an earlier period (see Table 1).

Table S4. Effect of parental death in period in childhood on boys' likelihood of death, Cox proportional hazard survival analysis, birth cohort 1900-1922

	Model 1: Age 0 to 20			Model 2: Age 0 to 20, controlled			Model 3: Age 0 to 1			Model 4: Age 1 to 5			Model 5: Age 5 to 12			Model 6: Age 12 to 20		
	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p
Parental death																		
No death age 0-20	*Ref*																	
Father dies age 0-20	1.14	0.63-2.00	.642	1.12	0.64-1.96	.692												
Mother dies age 0-20	1.08	0.63-1.86	.770	1.06	0.62-1.81	.839												
No death between 0-1							*Ref*			*Ref*			*Ref*			*Ref*		
Father 0-1							2.18	0.54-8.76	.273	1.18	0.11-5.97	.868	0.00	-	.995	0.00	-	.208
Mother 0-1							3.20	1.32-7.73	.015	0.82	0.16-8.58	.848	0.00	-	.995	3.58		.991
No death between 1-5							-			*Ref*			*Ref*			*Ref*		
Father 1-5							-			1.37	0.34-5.56	.656	0.00	-	.988	0.73		.755
Mother 1-5							-			0.00	-	.989	1.71	0.42-7.00	.456	0.00	-	.982
No death between 5-12							-			-			*Ref*			*Ref*		
Father 5-12							-			-			1.75	0.16-8.62	.866	1.33	1.07-3.55	.631
Mother 5-12							-			-			1.88	0.82-8.50	.105	0.35	0.77-3.03	.300
No death between 12-20																*Ref*		
Father 12-20																0.53	0.53-2.77	.525
Mother 12-20																1.82	0.81-3.80	.316
Events	1,059			1,059			653			255			77			74		
Observations	5,896			5,896			5,896			5,243			4,988			4,911		

Notes: Father/Mother death within age group under analysis are marked in grey; lagged effects are shown above the diagonal (e.g. effect of parental death between age 0-1 in on death child between age 1-5). Effects are hazard rates from proportional hazard Cox models. Models 2-6 control for the effects of socioeconomic status, region, period and death of the other parent as well as death of the parent in an earlier period (see Table 1).

Table S5. Effect of parental death in period in childhood on girls' likelihood of death, Cox proportional hazard survival analysis, birth cohort 1850-1879

	Model 1: Age 0 to 20			Model 2: Age 0 to 20, controlled			Model 3: Age 0 to 1			Model 4: Age 1 to 5			Model 5: Age 5 to 12			Model 6: Age 12 to 20		
	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p
Parental death																		
No death age 0-20	Ref																	
Father dies age 0-20	1.67	1.28-2.18	.000	1.72	1.32-2.24	.000												
Mother dies age 0-20	2.11	1.66-2.67	.000	2.19	1.72-2.78	.000												
No death between 0-1							Ref			Ref			Ref			Ref		
Father 0-1							1.99	0.25-4.09	.979	2.01	1.04-3.90	.039	0.954	0.13-6.86	.963	2.37	0.58-9.71	.231
Mother 0-1							4.89	3.61-8.78	.000	1.88	0.84-4.21	.126	0.00	-	.977	1.20	0.13-8.63	.855
No death between 1-5							-			Ref			Ref			Ref		
Father 1-5							-			0.71	0.25-1.90	.491	1.47	0.95-3.65	.072	1.70	0.75-3.89	.206
Mother 1-5							-			2.89	1.72-4.85	.000	2.17	1.24-4.22	.008	1.07	0.40-2.91	.891
No death between 5-12							-			-			Ref			Ref		
Father 5-12							-			-			2.32	1.22-4.44	.011	1.80	1.05-3.08	.033
Mother 5-12							-			-			1.34	0.55-3.28	.522	1.18	0.62-2.25	.612
No death between 12-20																Ref		
Father 12-20																2.16	1.12-4.15	.022
Mother 12-20																0.96	0.35-2.61	.941
Events	2,075			2,075			1,113			612			195			155		
Observations	5,730			5,730			5,730			4,617			4,005			3,810		

Notes: Father or mother death within age group under analysis are marked in grey; lagged effects are shown above the diagonal (e.g. effect of parental death between ages 0-1 on mortality between ages 1-5). Effects are hazard rates from proportional hazard Cox models. Models 2-6 control for the effects of birth order, socioeconomic status, region, and death of the other parent as well as death of the parent in an earlier period (see Table 1).

Table S6. Effect of parental death in period in childhood on girls' likelihood of death, Cox proportional hazard survival analysis, birth cohort 1880-1899

	Model 1: Age 0 to 20			Model 2: Age 0 to 20, controlled			Model 3: Age 0 to 1			Model 4: Age 1 to 5			Model 5: Age 5 to 12			Model 6: Age 12 to 20		
	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p
Parental death																		
No death age 0-20	Ref																	
Father dies age 0-20	1.77	1.04-2.08	.030	1.50	1.06-2.13	.022												
Mother dies age 0-20	2.54	1.98-3.26	.000	2.55	1.99-3.28	.000												
No death between 0-1							Ref			Ref			Ref			Ref		
Father 0-1							2.97	1.11-7.95	.030	2.42	1.08-5.44	.032	1.28	0.18-9.23	.804	0.00	-	.983
Mother 0-1							4.42	2.60-7.51	.000	1.43	0.46-4.45	.538	1.60	0.22-11.49	.640	2.01	0.28-14.46	.490
No death between 1-5							-			Ref			Ref			Ref		
Father 1-5							-			1.75	0.78-3.92	.177	0.83	0.26-2.61	.750	0.74	0.18-3.01	.677
Mother 1-5							-			2.52	1.34-4.75	.004	2.33	1.19-4.60	.014	0.61	0.15-2.47	.488
No death between 5-12							-			-			Ref			Ref		
Father 5-12							-			-			0.83	0.20-3.40	.800	1.64	0.83-3.25	.156
Mother 5-12							-			-			2.65	1.23-5.73	.013	1.51	0.73-3.10	.264
No death between 12-20																Ref		
Father 12-20																1.54	0.71-3.34	.277
Mother 12-20																3.07	1.58-5.69	.001
Events	1,813			1,813			1,018			518			152			125		
Observations	6,578			6,578			6,578			5,560			5,042			4,890		

Notes: Father or mother death within age group under analysis are marked in grey; lagged effects are shown above the diagonal (e.g. effect of parental death between ages 0-1 on mortality between ages 1-5). Effects are hazard rates from proportional hazard Cox models. Models 2-6 control for the effects of birth order, socioeconomic status, region, period and death of the other parent as well as death of the parent in an earlier period (see Table 1).

Table S7. Effect of parental death in period in childhood on girls' likelihood of death, Cox proportional hazard survival analysis, birth cohort 1900-1922

	Model 1: Age 0 to 20			Model 2: Age 0 to 20, controlled			Model 3: Age 0 to 1			Model 4: Age 1 to 5			Model 5: Age 5 to 12			Model 6: Age 12 to 20		
	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p	HR	95% CI	p
Parental death																		
No death age 0-20	*Ref*																	
Father dies age 0-20	2.13	1.32-3.43	.002	2.02	1.25-3.25	.004												
Mother dies age 0-20	1.59	0.95-2.64	.076	1.56	0.93-2.59	.089												
No death between 0-1							*Ref*			*Ref*			*Ref*			*Ref*		
Father 0-1							5.01	1.25-20.15	.023	1.94	0.22-11.11	.509	0.00	-		0.00	-	
Mother 0-1							3.93	1.46-10.58	.007	1.55	0.27-13.90	.664	0.00	-		0.00	-	
No death between 1-5							-			*Ref*			*Ref*			*Ref*		
Father 1-5							-			1.71	0.42-6.95	.451	1.72	0.42-7.10	.450	2.40	0.75-7.71	0.142
Mother 1-5							-			2.03	0.50-8.24	.320	0.98	0.13-7.07	.981	0.00	-	
No death between 5-12							-			-			*Ref*			*Ref*		
Father 5-12							-			-			2.05	0.49-8.42	.327	1.25	0.39-4.00	.705
Mother 5-12							-			-			1.73	0.42-7.17	.447	2.31	0.99-5.36	.052
No death between 12-20																*Ref*		
Father 12-20																2.15	0.78-5.94	.141
Mother 12-20																1.08	0.26-4.47	.915
Events	884			884			526			217			65			76		
Observations	5,558			5,558			5,558			5,032			4,815			4,750		

Table S8: Effect of paternal and maternal death and birth order on boys' likelihood of death, interaction models, Cox proportional hazard survival analysis

	Interaction with birth order linearly		Interaction with birth order categorically	
Parental death	Hazard ratio	P value	Hazard ratio	P value
Both parents survive	*Ref.*		*Ref.*	
Paternal death	2.618	.000	2.371	
Maternal death	1.827	.000	1.618	
Birth order * Paternal death	.861	.000		
Birth order * Maternal death	.997	.921		
Birth order * Paternal death				
Second son			1.417	0.021
Third son			0.938	0.002
Fourth son			1.598	0.002
Fifth son			0.742	0.070
Birth order * Maternal death				
Second son			0.593	0.086
Third son			0.450	0.796
Fourth son			0.363	0.085
Fifth son			0.531	0.364
Events	5,510		5,510	
Observations	18,814		18,814	

Notes: Signif. codes: 0 *** 0.001 ** 0.01 * 0.05 ' 0.1. All models are controlled for a time trend (secular trend in heights).

Table S9. Effect of parental death in childhood on height outcomes of boys in centimeters, by birth cohort, OLS regression model

	Obs.	1850-1879	1880-1899	1900-1922	Full model
No death in age interval	3041	Ref.	Ref.	Ref.	Ref.
Paternal death	537	0.84 '	-0.29	1.62 '	0.81 '
Maternal death	487	-1.16 *	-0.65	-0.61	-1.19 *
Both died	101	-0.73	-1.22	0.03	-0.77
Paternal death * 1880-1899					-1.10
Paternal death * 1900-1922					0.67
Maternal death * 1880-1899					0.52
Maternal death * 1900-1922					0.60
Both died * 1880-1899					-0.52
Both died * 1900-1922					1.03
Intercept		166.8	169.8	172.7	167.0
Adjusted R²		0.02	0.02	0.03	0.106
Observations		1,843	1,655	668	4,166

Signif. codes: 0 *** 0.001 ** 0.01 * 0.05 ' 0.1, The models control for the effects of socioeconomic status and region.

Table S10: Effect of parental death in period in childhood on height outcomes of boys in centimeters, per birth cohort, by age, OLS regression model

	Obs.	1850-1879	1880-1899	1900-1922	Full model
Parental death (timing)					
No death	*3041*	*Ref.*	*Ref.*	*Ref.*	*Ref.*
Paternal death between 0-1	21	-3.09	-3.02	1.46	-3.08
Paternal death between 1-5	87	1.27	-0.66	3.49	1.29
Paternal death between 5-12	192	1.28 '	0.45	2.85 '	1.23 '
Paternal death between 12-20	237	0.61	-0.51	0.13	0.57
Maternal death between 0-1	14	-1.95	-0.85	-0.61	-1.95
Maternal death between 1-5	113	0.48	-2.71 **	*-0.17*	-0.31
Maternal death between 5-12	158	-2.14 **	-0.85	-3.61 *	-2.19 **
Maternal death between 12-20	202	-1.04	0.54	1.31	-0.31
Both died	101	-0.73	-1.21	0.96	-0.78
Paternal death between 0-1 *1880-1899					0.05
Paternal death between 1-5 *1880-1899					-1.96
Paternal death between 5-12 *1880-1899					-0.82
Paternal death between 12-20 *1880-1899					-1.04
Paternal death between 0-1 *1900-1922					3.98
Paternal death between 1-5 *1900-1922					1.86
Paternal death between 5-12 *1900-1922					1.35
Paternal death between 12-20 *1900-1922					-0.36
Maternal death between 0-1 *1880-1899					0.91
Maternal death between 1-5 *1880-1899					-2.67 '
Maternal death between 5-12 *1880-1899					1.32
Maternal death between 12-20 *1880-1899					1.51
Maternal death between 0-1 *1900-1922					1.89
Maternal death between 1-5 *1900-1922					-0.27
Maternal death between 5-12 *1900-1922					-1.50
Maternal death between 12-20 *1900-1922					2.44
Both died *1880-1899					-0.52
Both died *1900-1922					1.04
Intercept		166.8	169.8	172.6	167.0
Adjusted R²		0.02	0.02	0.03	0.107
Observations		1,843	1,655	668	4,166

*Signif. codes: 0 *** 0.001 ** 0.01 * 0.05 ' 0.1, The models control for the effects of socioeconomic status and region*