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ORIGINAL ARTICLE

Parental divorce and adult longevity

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Abstract
Objective Life course research has established associations between adverse childhood events and later life health. We examine the relationship of experiencing parental divorce before the age of 16 and survival across 34 years of adulthood.
Methods Analysis of panel data from a USA-based survey of 6,928 adults residing in Alameda County, California in 1965. Cox regression was used to examine associations between parental divorce and longevity.
Results Controlling for age, race/ethnicity, gender, and childhood socioeconomic position, respondents who recalled a parental divorce during childhood had increased risk of mortality compared to those with no separation. The association was stronger for premature mortality and deaths due to cardiovascular disease. Divorce in childhood was also associated with lowered adult education, fewer social network ties, more depression, and worse health practices. These factors appeared to explain the association with longevity.
Conclusion Parental divorce in childhood is associated with lowered well-being in adulthood and long-term survival. Early prevention and health promotion efforts may be warranted for children who experience parental divorce or discord as a means of supporting enhanced trajectories of health and well-being.

Keywords Parent divorce · Survival · Health habits

Introduction

Social risk factors are increasingly recognized as important determinants of health status in childhood and through the life course. Low social class origins have long been recognized for their association with suboptimal health and longevity (Luo and Waite 2005; Turrell et al. 2007). A growing body of life course research is beginning to explain how different experiences in childhood impact health in later life (Halfon and Hochstein 2002). This includes research that links multiple adverse childhood experiences (e.g., abuse and neglect, domestic violence, parent mental illness) with future alcohol and drug dependence, respiratory illness, ischemic heart disease, and mortality (Dube et al. 2003; Felitti et al. 1998). Some studies have focused on family disruptions and specifically on parental divorce or parental death, showing long-term linkages with health. Children who experience parent divorce show elevated risk for a range of future physical health problems including obesity, poor self-rated health, asthma, cancer, and general chronic and acute illness (Hemminki and Chen 2006; Lorenz et al. 2006; Maier and

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Lachman 2000; Troxel and Matthews 2004; Yannakoulia et al. 2008). Associations for parental loss due to death are less consistent, although there is some evidence of heightened stress reactivity and reduced longevity (Nicolson 2004; Smith et al. 2009; Tyrka et al. 2008).

Little is known about the associations between parental divorce and survival. One investigation using a sample of gifted white children with an IQ greater than 130 enrolled in the Terman Lifecycle Study in 1921 showed that children who experience divorce had a lifespan that was on average 4 years shorter than others and that parental divorce was the strongest early life social correlate of mortality (Martin et al. 2005; Schwartz et al. 1995). Additional research is needed to determine if similar associations are found in individuals who are more representative of the general population, and to better understand the adult socioeconomic and health lifestyle risk factors that may be associated with parental divorce and longevity.

Many factors could place individuals who experience family disruptions in childhood at greater health risk. Parental absence, separation, and loss are associated with reduced income and lowered educational attainment, which in turn can impact health and longevity. A recent study in Sweden found that excess mortality associated with being born out of wedlock was explained by life course socioeconomic circumstances (Modin et al. 2009). Separation or loss of a parent can also influence other factors relevant to health, including social relationships, psychosocial functioning, and routine health practices like smoking and alcohol use (Gilman et al. 2003; Huurre et al. 2006; Kirby 2002; Thompson et al. 2008). Current research suggests stronger associations between divorce-related family disruptions and adult health and psychosocial functioning than exposure to parent death (Mack 2001; Maier and Lachman 2000). This may be because divorce acts as a proxy for family conflict or other stressful childhood circumstances.

This study examines associations between parental divorce prior to age 16 and longevity across 34 years of adulthood using data from a representative sample of adults residing in Alameda County, California in 1965. We investigate the linkages between parental divorce and survival and measures of adult well-being (educational attainment, social networks including partnership status and other social ties, depression, and health practices) that could contribute to the relationship. We also investigate whether parent divorce shows stronger linkages with premature mortality and deaths due to cardiovascular disease, and whether parental loss due to death shows similar associations. Prior research has shown stronger linkages between early social risk and premature mortality and specifically death from diseases like CVD that appear to be subject to psychosocial and behavioral influences (Beebe-Dimmer et al. 2004; Strand and Kunst 2007).

Methods

Sample

Our research uses panel data from the Alameda County Study conducted by the California State Department of Health. In 1965, the department used a stratified random household sampling procedure to recruit a representative sample of the non-institutionalized adult population in Alameda County. For the 4,452 housing units in the sample, all adults over age 20 (or who had ever been married) were eligible to participate. Of the 8,083 persons eligible, 6,928 (86 %) completed written surveys containing retrospective accounts of childhood circumstances and baseline information on health status, health habits, marital history, social networks, and detailed demographics. Non-respondents were compared to respondents on 13 basic demographic characteristics from census enumeration data and had only a few small differences (e.g., non-respondents were more likely older, white, and male) (Berkman 1983).

Follow-up surveys were sent approximately every 9 years in 1974, 1983, 1994, and 1999. For a mail survey, response rates were high, ranging from 85 to 95 % on subsequent surveys. All information was self-reported. Follow-up mortality records were obtained for the full sample through the end of 1999 using state death records, the national death index, and extensive in state and out of state tracing procedures. Approximately, 95 % of all deaths were successfully ascertained (Turrell et al. 2007).

Individuals not residing with both parents for reasons other than death or divorce were excluded from the study ($N = 172$). The final analytic sample further excluded 220 individuals with missing data on the study variables at baseline ($N = 6{,}536$). Respondents with missing data were similar to others on race/ethnicity, marital status, and income, but had lower education.

To investigate associations between parental divorce and premature mortality, analyses were also conducted for a younger sub-sample of individuals under the age of 41 years in 1965 ($N = 3{,}053$). Because survival was tracked for 34 years, we chose this age group to analyze mortality prior to age 75, which falls just short of the average USA life expectancy (74 years for men and 79 years for women in 2000) and might be considered premature mortality (Arias 2006). This criterion has been applied to an investigation of socioeconomic position and premature mortality on an earlier version of the data set and recent studies routinely focus on this age group (Baltrus et al. 2005; Beebe-Dimmer et al. 2004). The Alameda County sample contains a fair proportion of individuals who were over the age of 60 years at baseline (17 %). Prior studies of early social risk suggest stronger associations with longevity earlier in the life course (Beebe-Dimmer

et al. 2004; Tucker et al. 1997). There were 2,865 deaths in the full study sample and 435 deaths in the younger subsample. This study was exempt from the UCLA Institutional Review Board.

Measures

Primary outcome

Survival time was clocked in years beginning in 1965 and extended through the end of 1999. Those who had not died by 1999 were right censored at the end of the study. Deaths due to cardiovascular disease (CVD) were identified according to the international classification of diseases-ninth revision (codes 390–459) and include heart disease, circulatory disorders, and stroke. Cardiovascular disease represents a disease susceptible to social influences with numbers large enough for statistical precision.

Parent divorce

Childhood living arrangements were assessed at baseline by asking respondents if they lived with their "real father" and "real mother" for "all of the first 15 years of their life." Those with a response of no were asked to report what happened, with possible options of a parent died, parents divorced, or other. A three-category family disruption variable was constructed (no separation, divorce, a parent died). Sample size did not permit analyses for those not living with both parents for other reasons ($N = 172$). Respondents who experienced a childhood family disruption reported their age when this happened, permitting analyses for age at disruption.

Adult social and health lifestyle factors

Measures of adult well-being were included in each survey. Educational level was measured in years (top-coded at 18). Social networks were measured using the Berkman social network index, which has been shown to associate with health status across multiple previous studies (Berkman 1983; Loucks et al. 2006). Scores range from 0 to 12, and lower scores indicate fewer social network ties. The index is a weighted composite from items measuring four types of social ties: (1) partnership status, (2) number of close friends/relatives seen each month, (3) regular church attendance, and (4) membership in formal groups. Intimate contacts were weighted higher than other memberships. We chose the combined social network index instead of partnership status alone based on previous studies showing greater predictive value of the combined index (Berkman 1983) and preliminary analyses suggesting greater explanatory impact.

The HPL 18-item depression index, which has demonstrated validity and wide usage in the literature (Kaplan et al. 1987), counts the total number of depressive symptoms (e.g., difficulty relaxing, poor appetite, trouble sleeping) at each survey. Health behaviors were measured using Breslow's cumulative index of health practices (Breslow and Breslow 1993). The index adds the number of positive health habits from a list of seven: not a current smoker, moderate drinker, maintains good weight, often exercises, regularly eats breakfast, only sometimes/rarely/never snacks between meals, and sleeps 7–8 h each night. Moderate drinking was defined as never having five or more drinks in one sitting. A good weight was defined by a BMI of $\geq$18.5 and $<$25, which excluded individuals classified as underweight, overweight, or obese.

Study control variables include age at baseline, gender, race (white, black, other), and childhood socioeconomic position assessed by asking subjects to report their father's occupation and education. Detailed Census Bureau occupational codes were used to classify respondents—nonmanual (high), skilled manual (intermediate), and unskilled manual (low). When information was missing on father's occupation (6.4 % of cases), we substituted father's highest

Table 1 Descriptive statistics for study sample in 1965, Alameda County Study ($N = 6{,}536$)

	(%)
Family disruption	
No separation	71
Divorce	13
A parent died	16
Age	
40 years or under	47
41–60	37
Over 60	17
Gender	
Male	46
Female	54
Race	
White	80
Black	12
Other	8
Childhood socioeconomic position	
High	49
Intermediate	20
Low	31

All values given in %

Table 2 Measures of adult well-being in 1965 by parental divorce status, Alameda County Study ($N = 6{,}536$)

	Adult education (mean)[a]	Social network index (mean)[a]	Depression (mean)[a]	Health habits (mean)[a]
Family disruption				
No separation	12.05	5.76	2.15	4.85
Divorce	11.25[b]	5.04[b]	2.61[b]	4.55[b]
A parent died	11.04[b]	5.37[b]	2.43[b]	4.70[b]

[a] Means are age adjusted. *T* tests of mean differences were used to compare those who experienced parental divorce or death to those with no separation

[b] $p < 0.05$

Table 3 Bivariate association between specific health habits in 1965 and parental divorce status, Alameda County Study ($N = 6{,}536$)

	Not a current smoker (%)[a]	Moderate drinker (%)[a]	Maintains good weight (%)[a]	Often exercises (%)[a]	Regularly eats breakfast (%)[a]	Infrequently snacks between meals (%)[a]	Sleeps 7–8 h each night (%)[a]
Family disruption							
No separation	57	94	64	55	68	72	77
Divorce	47[b]	93	62	52	60[b]	70	74[b]
A parent died	52[b]	94	59[b]	56	64[b]	71	77

[a] Proportions are age adjusted. *Z* tests for proportions were used to compare those who experienced parental divorce or death to those with no separation

[b] $p < 0.05$

Table 4 Bivariate associations between parental divorce and adult mortality by age cohort and cause of death, Alameda County Study, 1965–1999

	Full sample ($N = 6{,}536$)		<41 in 1965 ($N = 3{,}053$)	
	Hazard ratio[a]	95 % CI	Hazard ratio[a]	95 % CI
All-cause mortality				
Divorce	1.23	1.09–1.39	1.53	1.19–1.92
A parent died	1.07	0.98–1.18	1.39	1.07–1.81
Cardiovascular mortality				
Divorce	1.33	1.10–1.60	1.85	1.22–2.80
A parent died	1.07	0.94–1.23	1.11	0.64–1.91
Death not due to cardiovascular mortality				
Divorce	1.15	0.99–1.35	1.39	1.04–1.86
A parent died	1.08	0.95–1.22	1.50	1.12–2.03

[a] Age-adjusted hazard ratio from Cox regression models

education—high school diploma (high), some high school (intermediate), and grammar school (low). Multiple imputations based on age, race, education, and childhood living arrangements were used for those with missing data on both (3.7 % of the sample). This coding was chosen to match previous studies using this data set (Beebe-Dimmer et al. 2004; Turrell et al. 2007). Father's education alone showed no association with longevity. Material circumstances of the home in childhood were not assessed.

Analysis

Cox proportional hazard regression was used to estimate survival models. Because of the age-heterogeneous nature of the study sample, an adjustment had to be made to correct for delayed entry into the risk set (Singer and Willett 2003). A time invariant control variable (age in 1965) was added to correct for delayed entry.

We present descriptive statistics (Table 1) and bivariate associations between family disruption and adult social and health lifestyle factors (Tables 2, 3). Bivariate associations between childhood family disruption and survival are presented as hazard ratios adjusted only for age (Table 4). Results are divided by age cohort (full sample/under age 41 in 1965) and cause of death (all-cause/CVD). Multivariable models added controls for confounders and adult social and health lifestyle factors (Table 5). A base model includes family disruption status plus confounders. Each proposed adult social and health lifestyle factor is next added independently in separate regression models that include the explanatory factor and controls for confounders. The final regression models include all adult social and health lifestyle factors simultaneously. Smoking status had a greater attenuating effect than the cumulative health habit index and was substituted in the final models. Adulthood social and health lifestyle factors were entered as time varying

Table 5 Results of Cox regression models predicting adult mortality, Alameda County Study, 1965–1999

	Full sample ($N = 6,536$)		<41 in 1965 ($N = 3,053$)	
	Hazard ratio	95 % CI	Hazard ratio	95 % CI
Base model				
Family disruption (vs. no separation)				
Divorce	1.23	1.08–1.40	1.47	1.14–1.89
A parent died	1.04	0.94–1.14	1.31	1.00–1.71
Age	1.10	1.09–1.10	1.12	1.10–1.13
Gender (vs. male)				
Female	0.66	0.61–0.71	0.68	0.56–0.82
Race (vs. white)				
Black	1.13	1.01–1.26	1.63	1.26–2.12
Other	0.88	0.75–1.02	1.19	0.89–1.60
Childhood socioeconomic position (vs. high)				
Intermediate	1.03	0.93–1.14	1.18	0.91–1.51
Low	1.11	1.02–1.21	1.28	1.03–1.59
Explanatory factors added to base model				
Model 1[a]				
Divorce	1.22	1.08–1.39	1.38	1.07–1.78
A parent died	1.02	0.93–1.12	1.25	0.96–1.63
Education	0.98	0.97–0.99	0.93	0.90–0.96
Model 2[a]				
Divorce	1.20	1.05–1.36	1.44	1.12–1.86
A parent died	1.01	0.92–1.11	1.28	0.98–1.66
Social networks	0.95	0.94–0.97	0.96	0.93–0.99
Model 3[a]				
Divorce	1.22	1.07–1.38	1.44	1.12–1.85
A parent died	1.03	0.94–1.13	1.25	0.96–1.63
Depression	1.06	1.05–1.08	1.10	1.07–1.14
Model 4[a]				
Divorce	1.20	1.06–1.37	1.41	1.09–1.81
A parent died	1.04	0.94–1.14	1.24	0.95–1.61
Health habits	0.84	0.82–0.87	0.82	0.77–0.88
Model 5[a]				
Divorce	1.17	1.03–1.33	1.34	1.05–1.71
A parent died	1.02	0.93–1.12	1.25	0.96–1.63
No smoking	0.60	0.56–0.65	0.46	0.38–0.56
Final model[a]				
Divorce	1.13	1.00–1.29	1.27	0.99–1.64
A parent died	0.99	0.90–1.09	1.18	0.90–1.54
Education	0.99	0.98–1.00	0.96	0.93–1.00
Social networks	0.97	0.96–0.98	0.95	0.95–1.02
Depression	1.05	1.03–1.06	1.07	1.04–1.11
No smoking	0.64	0.59–0.69	0.51	0.41–0.62

[a] Regression models include controls for all covariates in the base model (age, gender, race, childhood socioeconomic position)

Each proposed explanatory factor was added into the base model separately

Model 1 includes adult education, model 2 includes social networks, model 3 includes depression, model 4 includes the cumulative health habit index, and model 5 includes smoking status

The final model includes all adult social and health lifestyle factors together

covariates with the last value carried forward for those with missing data on subsequent surveys.

Results

Descriptive statistics

Table 1 presents the descriptive characteristics for the study sample in 1965. Most respondents had no family disruption prior to the age of 16 years (71 %). Parental loss due to death was slightly more common (16 %) than parental divorce (13 %). Nearly half of the respondents were under the age of 41 at baseline (47 %), and just over half were female (54 %). Seventeen percent of respondents were already over age 60 at the start of the study.

Parent divorce and adult social and health lifestyle factors

Children from divorced families had consistently worse scores on adult education, social networks, depression, and health habits at baseline compared with those in families with no separation (Table 2). Individuals who lost a parent due to death also fared worse than those with no parental loss, but t tests of mean difference (not shown) revealed these children had significantly more social network connections, less depression, and more positive health practices ($p < .05$) than those who experienced parental divorce.

Table 3 shows bivariate associations between family disruption and specific health practices in 1965. Individuals from families with no parent separation were more likely than those who experienced parental divorce to eat breakfast regularly, not smoke, and report good sleep each night. The association with smoking was particularly strong. Fifty-seven percent of those with no parental separation were not current smokers, compared with only 47 % of those who had a parental divorce.

Bivariate associations: parent divorce and survival

In age-adjusted models, respondents who recalled a parent divorce had a 23 % increased risk for all-cause mortality (HR: 1.23, 95 % CI: 1.09–1.39) compared to those with no separation (Table 4). The association was stronger for a younger sub-sample of adults under age 41 in 1965 (HR: 1.53, CI: 1.19–1.92). Cardio vascular disease deaths appeared to have a stronger association with parental divorce than non-CVD deaths. Parent divorce was associated with a 33 % higher CVD mortality risk in the full sample (HR: 1.33, CI: 1.10–1.60) and 85 % higher CVD mortality risk in the younger sub-sample (HR: 1.85, CI: 1.22–2.80). Parental loss due to death does not seem to have the same impact. Separate analyses (not shown) revealed that survival did not vary by age of family disruption and there were no significant statistical interactions between family disruption and gender in predicting longevity.

Multivariate associations: parent divorce and survival

Parental divorce remained associated with longevity with controls for age, race/ethnicity, gender, and childhood socioeconomic position (Table 5). The adjusted all-cause mortality hazard ratios for parent divorce (full sample HR: 1.23, CI: 1.08–1.40; <41 HR: 1.47, CI: 1.14–1.89) were of greater magnitude than low childhood socioeconomic position (full sample HR: 1.11, CI: 1.02–1.21; <41 HR: 1.28, CI: 1.03–1.59). Parent death showed no association with longevity. Adult education, social networks, depression, cumulative health habits, and smoking status were each added independently into the base models in a series of separate regressions (Table 5). The parent divorce coefficient showed a small amount of attenuation with the addition of each separate factor, but smoking had the most impact. For the <41 age group, the excess mortality risk associated with parental divorce was reduced to 38 % (HR: 1.38, CI: 1.07–1.78) in a model with educational attainment and 34 % in a model with smoking status (HR 1.34, CI: 1.05–1.71).

With all mediators added simultaneously into the models (Table 5), the hazard ratios connected with parent divorce were no longer significant. Analyses (not shown) also revealed a reduction in the excess risk of CVD mortality for parent divorce with the addition of all mediators in the full sample (covariate-adjusted HR: 1.31, CI: 1.08–1.59 vs. final HR: 1.21, CI: 0.99–1.47) and younger sub-sample (covariate-adjusted HR: 1.68, CI: 1.07–2.64 vs. final HR: 1.52, CI: 0.97–2.39).

Discussion

Prior research has established associations between parental divorce and many negative outcomes for children including depression, behavior problems, and school failure (Lansford et al. 2006). This study joins a growing body of life course investigations that link parental separation with more long-term negative health and well-being indicators across adulthood (Gilman et al. 2003; Hemminki and Chen 2006; Lorenz et al. 2006; Maier and Lachman 2000). Specifically, the study uncovered associations between parent divorce and four adult risk factors—lowered educational attainment, fewer social network ties, depression, and unhealthy habits (smoking in particular)—which in

turn appeared to contribute to differentials in longevity. The associations found between parent divorce and longevity in this study and two earlier investigations are somewhat modest in magnitude, but likely still important at the population level. Notably, parent divorce showed a stronger association with survival than childhood socioeconomic position, a widely studied contributor to health and longevity (Beebe-Dimmer et al. 2004; Luo and Waite 2005; Turrell et al. 2007).

Family disruptions due to divorce showed stronger associations with adult well-being, health practices and longevity than parental loss due to death. These findings are consistent with other studies and reinforce a need to consider the differential impact of each (Mack 2001). One possible explanation involves the distinction between "tolerable" and "toxic" stress (National Scientific Counsel on the Developing Child 2005). Death or serious illness of a family member may be a tolerable developmental stressor buffered by supportive family relationships that facilitate coping. Depending on circumstances, family breakup from divorce might carry more toxic developmental exposures (e.g., poverty, conflict) that in turn impact health. Studies of children's well-being suggest that many children fare well following parent divorce, and it is not divorce per se that is harmful for children, but rather the conflict and parenting disruptions that are often attendant (Kelly 2000). The associations observed in this study likely arise because divorce acts as a proxy for a range of adverse circumstances relevant to future health. It is also possible that selection processes could be responsible. For example, parents with poor health might be more likely to divorce and pass worse health onto their children through genetics. However, in terms of a genetic linkage, it is interesting that divorce, not parent death, had an association with CVD and longevity, given the expectation that early parental death may relate to heritable causes.

Prior studies have shown that childhood socioeconomic position shows a stronger association with mortality from certain causes like CVD (Beebe-Dimmer et al. 2004; Strand and Kunst 2007). Likewise, this study suggests that parental divorce may have a stronger association with CVD than non-CVD mortality. Cardio vascular disease is prototypical for a disease with a long incubation period where cumulative and socially patterned risk factors such as stress, smoking, inactivity, and economic insecurity have been implicated in etiology. Children who experienced parental divorce may have heightened risk for the types of socially patterned exposures that impact CVD development. Along similar lines, a study in Sweden found that offspring from divorced families had an increased risk for developing cancers related to tobacco, alcohol, and sexual practices (e.g., pancreatic, lung, and cervical cancers) but not for cancers arising from other causes (Hemminki and Chen 2006).

Parental divorce had a stronger association with longevity for a younger sub-sample of individuals under the age of 41 years, which may be indicative of a greater impact on premature mortality than old-age mortality. Similar results were found in the Terman Lifecycle Study of parent divorce and survival (Tucker et al. 1997), and also in studies of associations between childhood socioeconomic position and adult longevity using Alameda County data (Beebe-Dimmer et al. 2004). It may be that beyond a certain age, social disparities begin to even out due to normal biological aging or selective survival of more resilient individuals from disadvantaged groups. In the current study, a considerable proportion of individuals (17 %) were over the age of 60 at baseline which could introduce a form of bias by selecting healthy individuals who have already survived to older age and may help explain the relatively small association between parent divorce and longevity in the full sample. Findings are consistent with a broader literature showing diminished social gradients in health in older age (House et al. 1990).

Consistent with prior research, parental divorce was associated with a range of social, psychosocial, and health lifestyle measures in adulthood. These factors appeared to contribute to the relationship between divorce and survival, with smoking showing the greatest impact. Multiple studies document an increased risk for health-compromising behaviors (smoking, alcohol use, and risky sexual practices) in adolescence and adulthood for those who experience parental marital discord and dissolution (Huurre et al. 2006; Kirby 2002; Thompson et al. 2008). A limitation of this study and others is that measures were not available to control for health practices prior to family breakup. A rare study from the National Longitudinal Survey of Adolescent Health found that those who experienced parental divorce had considerably increased risk of new smoking initiation (Kirby 2002). Future research is needed to further tease out the nature of these relationships. Contrary to other studies, we did not find an association between parent divorce and alcohol use, which could reflect a more moderate measure of alcoholism (Thompson et al. 2008). Life course theoretical models posit various mechanisms through which early social circumstances may influence adult health. Our results are consistent with pathway mechanisms emphasizing the importance of adult social and health lifestyle factors, but we cannot rule out other possible mechanisms such as the latent impact of epigenetic influences. New evidence is mounting to suggest that parent divorce and other family disruptions in childhood may up-regulate the HPA axis for overactive stress responses that over time can damage biological systems and cause disease (Nicolson, 2004; Tyrka et al. 2008).

Study findings highlight a need to consider the life course health ramifications of early social risk.

Interventions to assist families with conflict/tensions and separation/divorce may prevent immediate child adjustment problems and also the cascading effects that could lead to future health disparities (Troxel and Matthews 2004). Several controlled randomized trials have demonstrated that prevention programs for children of divorced parents lead to improved social trajectories and better future health practices and health outcomes (Haine et al. 2003). For example, an experimental evaluation of two multifaceted postdivorce interventions for custodial mothers and their children showed at a 6-year follow-up that intervention participants had fewer sexual partners, fewer mental health disorders, better academic competence, and lower levels of alcohol, marijuana, and other drug use compared with study controls (Wolchik et al. 2002). These findings suggest it may be possible to intervene on the pathways that could place children at risk for future health problems.

This study has several limitations. The results only report associations and no conclusions can be made about causality. Our study cannot rule out genetic explanations, selection processes, or other possible third factor explanations such as divorce acting as a proxy for other detrimental exposures. Future studies with measures of child health and health behaviors prior to the divorce could help rule out possible selection mechanisms. Retrospective accounts of childhood circumstances could be subject to recall bias and the study contained survey non-response and missing data. Parent divorce associations were somewhat modest, and it is likely that more direct measures of marital conflict and parenting disruptions would yield associations of greater magnitude. We were unable to compare children of divorce and those born into single parent families. Recent studies in Sweden and Denmark found decreased longevity for individuals born to single non-married mothers suggesting the importance of family structures other than divorce (Lund et al. 2006; Modin et al. 2009).

Furthermore, results come from an older cohort of individuals who grew up when divorce was less common and are also limited to one county in the USA state of California. The reduced effect hypothesis suggests that as divorce has become much more commonplace around the globe, the impact on child health and well-being should lessen due to diminished social stigma and reduced family stress associated with marital dissolution (Ely et al. 1999). Empirical evidence is limited, although some studies indicate no attenuation of the parent divorce associations with adult well-being across recent decades (Ely et al. 1999; Sigle-Rushton et al. 2005).

Each year, more than one million children in the USA experience a parental divorce. Parent separation can be emotionally traumatic for children, with negative social and health consequences that extend into adulthood. Awareness is growing about the tremendous public health impact of social and psychosocial risks in childhood such as abuse and violence exposure. Although divorce and moderate family conflict might not carry similar levels of risk as severe family disturbances, the high divorce rate in the USA and several other countries around the globe means a high proportion of children could be placed at risk and studies also show that family breakups can combine with other adverse exposures to exert a large cumulative impact on health (Dube et al. 2003). Early health promotion efforts may be warranted to assist families with positive adaptations to divorce and changes in family structure, or conflict and other psychosocial disturbances, and advocacy efforts should address the larger social factors (e.g., poverty) that can impact family dynamics and functioning.

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References

Arias E (2006) United States life tables, 2003. Natl Vital Stat Rep 54(14):1–40

Baltrus PT, Lynch JW, Everson-Rose S, Raghunathan TE, Kaplan GA (2005) Race/ethnicity, life-course socioeconomic position, and body weight trajectories over 34 years: the Alameda County Study. Am J Public Health 95:1595–1601

Beebe-Dimmer J, Lynch JW, Turrell G, Lustgarten S, Raghunathan T, Kaplan GA (2004) Childhood and adult socioeconomic conditions and 31-year mortality risk in women. Am J Epidemiol 159:481–490

Berkman LF (1983) Health and ways of living: the Alameda County Study. Oxford University Press, New York

Breslow L, Breslow N (1993) Health practices and disability: some evidence from Alameda County. Prev Med 22:86–95

Dube SR, Felitti VJ, Dong M, Giles WH, Anda RF (2003) The impact of adverse childhood experiences on health problems: evidence from four birth cohorts dating back to 1900. Prev Med 37:268–277

Ely M, Richards MPM, Wadsworth MEJ, Elliott BJ (1999) Secular changes in the association of parental divorce and children's educational attainment: evidence from three British birth cohorts. J Soc Policy 28:464–495

Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, Koss MP, Marks JS (1998) Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The adverse childhood experiences (ACE) study. Am J Prev Med 14:245–258

Gilman SE, Kawachi I, Fitzmaurice GM, Buka SL (2003) Family disruption in childhood and risk of adult depression. Am J Psychiatry 160:939–946

Haine RA, Sandler IN, Wolchik SA, Tein JY, Dawson-McClure SR (2003) Changing the legacy of divorce: evidence from prevention programs and future directions. Fam Relat 52:397–405

Halfon N, Hochstein M (2002) Life course health development: an integrated framework for developing health, policy, and research. Milbank Q 80:433–479

Hemminki K, Chen B (2006) Lifestyle and cancer: effect of parental divorce. Eur J Cancer Prev 15:524–530

House JS, Kessler RC, Herzog AR (1990) Age, socioeconomic status, and health. Milbank Q 68:383–411

Huurre T, Junkkari H, Aro H (2006) Long-term psychosocial effects of parental divorce: a follow-up study from adolescence to adulthood. Eur Arch Psychiatry Clin Neurosci 256:256–263

Kaplan GA, Roberts RE, Camacho TC, Coyne JC (1987) Psychosocial predictors of depression. Prospective evidence from the human population laboratory studies. Am J Epidemiol 125:206–220

Kelly JB (2000) Children's adjustment in conflicted marriage and divorce: a decade review of research. J Am Acad Child Adolesc Psychiatry 39:963–973

Kirby JB (2002) The influence of parental separation on smoking initiation in adolescents. J Health Soc Behav 43:56–71

Lansford JE, Malone PS, Castellino DR, Dodge KA, Pettit GS, Bates JE (2006) Trajectories of internalizing, externalizing, and grades for children who have and have not experienced their parents' divorce or separation. J Fam Psychol 20:292–301

Lorenz FO, Wickrama KA, Conger RD, Elder GH Jr (2006) The short-term and decade-long effects of divorce on women's midlife health. J Health Soc Behav 47:111–125

Loucks EB, Sullivan LM, D'Agostino RB Sr, Larson MG, Berkman LF, Benjamin EJ (2006) Social networks and inflammatory markers in the Framingham Heart Study. J Biosoc Sci 38:835–842

Lund R, Christensen U, Holstein BE, Due P, Osler M (2006) Influence of marital history over two and three generations on early death. A longtidutinal study of Danish men born in 1953. J Epidemiol Community Health 60:496–501

Luo Y, Waite LJ (2005) The impact of childhood and adult SES on physical, mental, and cognitive well-being in later life. J Gerontol B Psychol Sci Soc Sci 60:S93–S101

Mack KY (2001) Childhood family disruptions and adult well-being: the differential effects of divorce and parental death. Death Stud 25:419–443

Maier E, Lachman M (2000) Consequences of early parental loss and separation for health and well-being in midlife. Int J Behav Dev 24:183–189

Martin LR, Friedman HS, Clark KM, Tucker JS (2005) Longevity following the experience of parental divorce. Soc Sci Med 61:2177–2189

Modin B, Koupil I, Vagero D (2009) The impact of early twentieth century illegitimacy across three generations. Longevity and intergenerational health correlates. Soc Sci Med 68:1633–1640

National Scientific Counsel on the Developing Child (2005) Excessive stress disrupts the architecture of the brain. In: 3rd NSCDC working paper presented at Brandeis University, Waltham, 2005

Nicolson NA (2004) Childhood parental loss and cortisol levels in adult men. Psychoneuroendocrinology 29:1012–1018

Schwartz JE, Friedman HS, Tucker JS, Tomlinson-Keasey C, Wingard DL, Criqui MH (1995) Sociodemographic and psychosocial factors in childhood as predictors of adult mortality. Am J Public Health 85:1237–1245

Sigle-Rushton W, Hobcract J, Kiernan K (2005) Parental disruption and adult well-being: a cross cohort comparison. Demography 42:427–446

Singer JD, Willett JB (2003) Applied longitudinal data analysis: modeling change and event occurrence. Oxford University Press, New York

Smith KR, Mineau GP, Garibotti G, Kerber R (2009) Effects of childhood and middle-adulthood family conditions on later-life mortality: evidence from the Utah population database, 1850–2002. Soc Sci Med 68:1649–1658

Strand BH, Kunst A (2007) Childhood socioeconomic position and cause-specific mortality in early adulthood. Am J Epidemiol 165:85–93

Thompson RG Jr, Lizardi D, Keyes KM, Hasin DS (2008) Childhood or adolescent parental divorce/separation, parental history of alcohol problems, and offspring lifetime alcohol dependence. Drug Alcohol Depend 98:264–269

Troxel WM, Matthews KA (2004) What are the costs of marital conflict and dissolution to children's physical health? Clin Child Fam Psychol Rev 7:29–57

Tucker JS, Friedman HS, Schwartz JE, Criqui MH, Tomlinson-Keasey C, Wingard DL, Martin LR (1997) Parental divorce: effects on individual behavior and longevity. J Pers Soc Psychol 73:381–391

Turrell G, Lynch JW, Leite C, Raghunathan T, Kaplan GA (2007) Socioeconomic disadvantage in childhood and across the life course and all-cause mortality and physical function in adulthood: evidence from the Alameda County Study. J Epidemiol Community Health 61:723–730

Tyrka AR, Wier L, Price LH, Ross N, Anderson GM, Wilkinson CW, Carpenter LL (2008) Childhood parental loss and adult hypothalamic–pituitary–adrenal function. Biol Psychiatry 63:1147–1154

Wolchik SA, Sandler IN, Millsap RE, Plummer BA, Greene SM, Anderson ER, Dawson-McClure SR, Hipke K, Haine RA (2002) Six-year follow-up of preventive interventions for children of divorce: a randomized controlled trial. JAMA 288:1874–1881

Yannakoulia M, Papanikolaou K, Hatzopoulou I, Efstathiou E, Papoutsakis C, Dedoussis GV (2008) Association between family divorce and children's BMI and meal patterns: the GENDAI Study. Obesity (Silver Spring) 16:1382–1387