

Is the higher rate of parental child homicide in stepfamilies an effect of non-genetic relatedness?

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Abstract In an evolutionary perspective individuals are expected to vary the degree of parental love and care in relation to the fitness value that a child represents. Hence, stepparents are expected to show less solicitude than genetically related parents, and this lack of genetic relatedness has been used to explain the higher frequencies of child abuse and homicide found in stepfamilies. However, other factors than non-genetic relatedness may cause this over-representation in stepfamilies. Here we use a 45-year data set of parental child homicides in Sweden to test two hypotheses related to the higher incidence in stepfamilies: 1) adults in different types of family differ in their general disposition to use violence, and 2) parents are more likely to kill stepchildren than genetically related children. Of the 152 perpetrators in biparental families there was an overrepresentation of perpetrators in stepfamilies ($n=27$) compared with the general population. We found support for the first hypothesis in that both general and violent crime rates were higher in stepfamilies, both in the general population and among perpetrators of child homicide. However, we found no support for the second hypothesis because of the 27 perpetrators in stepfamilies the perpetrator killed a genetically related child in 13 cases, a stepchild in 13 cases and both types of children in one case. Moreover, out of the 12 families where the perpetrator lived with both stepchildren and genetic children, there was no bias towards killing stepchildren. Thus, we found no evidence for an effect of non-genetic relatedness per se [*Current Zoology* 57 (3): 253–259, 2011].

Keywords Cinderella effect, Alternative explanations, Characteristics of parents, Previous criminality, Violence

Human children require more care than the young of any other primate species and hence parental investment in child rearing represents a substantial cost (e.g., Lancaster and Lancaster, 1983; Hames, 1988; Crawford and Krebs, 2008). From a Darwinian perspective, a cost must be coupled with fitness benefits to be evolutionarily stable (Barrett et al., 2001; Cartwright 2008). One mechanism suggested to ensure that the investment of resources maximizes fitness is that individuals vary their degree of parental love and care towards a child relative to the fitness value that the child represents for them (Daly and Wilson, 1994). This “Child-specific parental love is the emotional mechanism that permits people to tolerate – even to rejoice in – those long years of expensive, unreciprocated parental investment” (Daly and Wilson 1988, p. 83). A consequence of this is that parents with low degrees of “parental love” towards a child, i.e. parents with children not genetically related to them, should be more likely to abuse and, in the extreme case, kill such children than would parents with genetically related children (Daly and Wilson, 1988).

These ideas have been tested by comparing the fre-

quencies of parental child homicide in stepfamilies with those in families with two genetic parents. Daly and Wilson (1988) showed that children in stepfamilies are at a significantly higher risk of being the victims of parental child homicide than children in families with two genetic parents. They concluded that having a stepparent is the most powerful risk factor for children yet discovered, and that this increased risk is explained by kin selection theory, the so called Cinderella-effect (Daly and Wilson, 1988; 1998). Other studies have confirmed the relatively high risk for stepchildren (Harris et al., 2007; Weekes-Shackelford and Shackelford, 2004).

One question that we want to highlight in the present paper is whether an increased risk of child homicide in stepfamilies is a direct effect of the lack of genetic relatedness between parent and child in such families. Another explanation could be that other variables are correlated with stepfamilies and these variables could be more influential on the risk of child homicide

Early studies by Gil (1969) in the USA and by Ferguson et al. (1972) in New Zealand reported an over-representation of victims in stepfamilies, but focused on

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the multidimensional character of child abuse. For instance, they showed that abusers often had previous criminal convictions and/or personality characteristics of anxiety, depression and irritability, had a lower educational level than average, and were more often unemployed. More recently, Turner et al. (2007) suggested that adults with a pre-existing dysfunction are more likely to select into stepfamilies and to have characteristics that increase the risk of child maltreatment. They showed that parents in stepfamilies were more likely to have a history of employment difficulties, multiple relationships and family conflict before entering a stepfamily.

One factor that should increase the risk for child maltreatment and especially child abuse is if a certain family type includes more violent men or women. Giles-Sims and Finkelhor (1984) suggested that an over-representation of victims of child abuse in stepfamilies may occur because there are differences between adults in different types of family in their general disposition to use violence; adults who are more violent are less likely to stay in a relationship and are thus less likely to live in intact families.

It is also known that criminality in general is associated with child maltreatment. In a study of children who had been severely abused in Australia, Stanley and Goddard (2004) concluded that "...severe maltreatment of children is often associated with other criminal and anti-social behavior, both inside and outside the family" (p. 256), and that "...seeking change in behavior by targeting on only one form of violence and/or criminal activity, child abuse, may be extremely unrealistic in families where there would often appear to be a general breakdown in boundaries between behavior within, and behavior outside, societal standards and norms" (p. 258).

It has been claimed, however, that even if there are other differences between stepfamilies and families with two genetic parents than the non-genetic relatedness between stepparent and stepchild, these differences cannot explain the Cinderella-effect, since the violence in families that include both stepchildren and genetic children is discriminatively targeted towards the stepchildren (Daly and Wilson, 2001). Lightcap et al. (1982) and Daly and Wilson (1985) report that stepchildren were selectively abused in families with both stepchildren and children of the current marital union. It is then interesting to investigate the relative risk for stepparents and genetic parents in stepfamilies to become perpetrators of child homicide.

Using a dataset on parental child homicides from Sweden, Temrin et al. (2004) focused on the victims and showed an increased risk in stepfamilies only for the youngest children. We now have a larger data set on child homicides committed in Sweden (from 1965 through 2009), and in the present study we focus on the perpetrators and show that parents in stepfamilies are more likely to commit child homicide than are parents in families with two genetic parents. We then investigate plausible reasons for this difference. As we see it, there are two main hypotheses that we can test. One has to do with the selection of individuals with certain characteristics into stepfamilies, specifically, that parents in stepfamilies are more likely to be prone to criminal behavior in general, and/or violence in particular, than parents in families with two genetic parents. In comparison to an explanation based on genetic relatedness (see below) this could be viewed as a spurious or confounding factor that may help to explain the higher incidence of child homicide among parents in stepfamilies. We test this hypothesis by comparing crime rates among parents in different family types in the general population, and previous crime rates among the parent perpetrators in different family types.

The other hypothesis, not mutually exclusive from the first, is that parents are more likely to kill stepchildren than genetically related children. This is an ultimate, evolutionary explanation based on kin selection theory that would also give rise to an increased incidence of child homicides among parents in stepfamilies. However, because there is a difference in child homicide rates between the two family types, and because there is no measurable variation in genetic relatedness to the child victim among parents in families with two genetic parents, we test this hypothesis by investigating perpetrators in stepfamilies only. Thus, we ask whether parents in stepfamilies are more likely to kill stepchildren than genetically related children. Further on, we ask whether, in a situation where a perpetrator lives with both genetic and stepchildren, he/she is more likely to kill the stepchild, which would be expected from the Cinderella hypothesis.

1 Materials and Methods

1.1 Parental child homicide data

Our data set comprises all solved cases of parental child homicides committed in Sweden from the start of 1965 to the end of 2009. The data set consists of two overlapping parts. First, Statistics Sweden provided two of the authors (HT and JN; see also Nordlund and Tem-

rin, 2007) with information about the identity of all children in Sweden who died as a result of violence from another individual during the period 1965–1999 (35 years). A case was considered to be solved when the police had identified the killer and/or when the perpetrator had been convicted; some perpetrators committed suicide and in these cases the police identified the killer without an ensuing court sentence. We then separated out all parental child homicides in this data set. Next, for the period 1990–2009 all parental child homicides in Sweden reported to the police were examined by one of the authors (MR). Hence, with the overlapping data set for the years 1990–1999 we had the opportunity to investigate the reliability of the two sources, i.e. homicides recorded by Statistics Sweden and directly by the police, respectively. We had found the same cases during these overlapping years which justifies our decision to combine the two datasets.

We compared the risk for parents to commit child homicide in two types of biparental family, 1) with two genetic parents, and 2) stepfamily. A stepfamily is defined as a family where there is at least one steprelation between a child and a parent. Both stepfamilies and families with two genetic parents are defined as families when the two parents are cohabiting. In modern Sweden around 50% of all children are born out of wedlock (e.g., Lindqvist Forsberg and Tullberg 1995). As is the case for all studies based on similar data sources as ours, genetic relatedness is putative, i.e. there is always some uncertainty about the relatedness between parent and child, especially for fathers.

All child-victims were less than 16 years old. The average age of the child victims in families with two genetic parents was 4.9 years ($n=156$) and in stepfamilies 4.9 years ($n=31$). There were 125 perpetrators in 120 families with two genetic parents and 27 perpetrators in 25 stepfamilies in the data set. The average number of victims was 1.3 both for the 120 families with two genetic parents and for the 25 stepfamilies. The average age of perpetrators in families with two genetic parents was 34.7 years ($n=123$; age of two perpetrators missing) and in stepfamilies 32.0 years ($n=27$).

1.2 Frequencies of parents in different types of family in the general population

Statistics Sweden provided data on the frequencies of parents in different types of family living with children younger than 18 years from two surveys, 1985 and 1990. This enabled us to determine the frequencies of perpetrators of child homicide in different types of family relative to the frequencies of parents in the same types

of family in the general population. In the present study we have used the average number of parents from these two years, since this is close to the midpoint year 1987 of the period 1965–2009 for which we have data on parental child homicide.

Statistics Sweden provided us with the age of the youngest parent in each of the families in the data bases from 1985 and 1990. The average age of these parents of 1985 was 34.5 for stepfamilies ($n=96, 677$) and 36.2 years for families with two genetic parents ($n=765, 471$). For 1990 the average age was 35.0 years for stepfamilies ($n=89, 044$) and 36.2 years for families with two genetic parents ($n=734, 743$).

1.3 Criminality among parents in different types of family in the general population

The data on criminality in the general population is based on the data base of The Swedish National Council for Crime Prevention, which Statistics Sweden used to search for criminal records in the two data bases of parents living with children (<18 yrs old) in different family types in 1985 and 1990. By this procedure, Statistics Sweden provided data on the frequencies of parents convicted in Sweden during the years 1973–2004 in two types of biparental family, families with two genetic parents and stepfamilies. Two categories of crime were considered: crimes in general and violent crimes, as described below. Each person is only counted once for each category of crime, independently of the number of crimes for which he/she has been convicted. We used the average number of parents with criminal records in the data bases of 1985 and 1990.

1.4 Previous criminality among perpetrators of parental child homicide

Data on previous crimes committed by the perpetrators of parental child homicide was obtained from The Swedish National Council for Crime Prevention. Two categories of crimes were included: "crimes in general" and "violent crimes". Crimes in general included any crime that had led to a conviction, while violent crimes were those that had been directed towards other adult men or women, and included murder, manslaughter, assault, robbery and rape. We want to emphasize that the parental child homicides of the perpetrators and any earlier physical abuse towards the victim were not included in these categories.

The database of The Swedish National Council for Crime Prevention includes data about convictions from 1973 onwards. Since the database started in 1973, only perpetrators who had committed parental child homicide after 1976 were included in the analyses of the perpe-

trators' previous criminality, so that there would be at least a few years (1973–1976) when crimes could have been committed before the parental child homicide. Nevertheless, it could be argued that the likelihood to be registered as a criminal increases with age. The average age of the perpetrators of parental child homicides included in the crime register was 32.7 ($n=21$) for stepfamilies and 34.7 years ($n=69$) for families with two genetic parents.

1.5 Statistical methods

We used the average number of parents in the general population living in the different types of family in 1985 and 1990, as described above. This value is close to the midpoint year (1987) of the study period 1965–2009. Then we compared the observed frequencies of parents committing child homicide with expected frequencies, based upon the frequencies of parents in the two family types in the general population, using Chi-square tests (Table 1). The frequencies of perpetrators with a previous criminal record in the two types of family in the general population (Table 2) and among the perpetrators (Table 3) were compared using contingency tables (StatView 5.0.1). Finally, the frequencies of parents with and without genetic relatedness to the child homicide victim within stepfamilies were compared to an expected 1:1 ratio using a Chi-square test (Table 4).

2 Results

The estimated frequency of perpetrators of parental child homicide in the Swedish population is signifi-

cantly higher among parents living in stepfamilies than among parents living in families with two genetic parents (Table 1). This indicates that these two family types differ in some respect that increases the risk of child homicide and we may look for possible explanations for this heightened risk of becoming a perpetrator in a stepfamily. We first tested whether individuals that are prone to crime in general, and/or violent crime in particular, have a higher probability of living as parents in stepfamilies than in families with two genetic parents.

When different families were compared in the total population, we found that parents in stepfamilies had a higher incidence of both crime in general and violent crime than parents in families with two genetic parents (Table 2). The incidence of crime in general was about 1.5 times higher and that of violent crime about two times higher among parents in stepfamilies (Table 2). This shows that there is indeed a selection of crime prone individuals into stepfamilies. The situation is also well reflected in our specific data set on child homicide. Thus, among parental perpetrators the incidence of previous crimes being committed was significantly higher among the parents in stepfamilies than among the parents in families with two genetic parents. However, not surprisingly, the incidence of previous crimes was generally much higher among our perpetrators of child homicide than the incidence of crime in the general population (cf. Tables 2 and 3). Thus, we conclude that there is a selection of crime prone individuals into step

Table 1 The annual average of perpetrators of child homicide per million parents in families with two genetic parents and stepfamilies, respectively, in the general population

	Perpetrators in families with two genetic parents	Perpetrators in stepfamilies (with 1 genetic and 1 stepparent)	
Perpetrators per million parents and year	1.9 (125; 1 500 214)	3.2 (27; 185 722)	$\chi^2=7.145$ $P=0.008$

The number of perpetrators during the years 1965–2009 (45 years) and the number of parents in the different types of family in the general population (1987; see Methods) are given within parentheses.

Table 2 Frequencies of parents with criminal records, for crimes in general and for violent crimes in particular, in different types of family in the Swedish population

	Two genetic parents	Parents in stepfamilies	
Crimes in general	17.8% (266 525/1 500 214)	28.2% (52 353/185 722)	$\chi^2=11 706.86$; $P<0.0001$
Violent crimes	1.9% (28 209/1 500 214)	4.4% (8 146/185 722)	$\chi^2=4 918.25$; $P<0.0001$

The number of parents with a criminal record and the total number of parents (see Methods) within parentheses.

Table 3 Frequencies of parents with previous criminal records in different types of family among the perpetrators of parental child homicide where data are available (see Methods; numbers within parentheses)

	Two genetic parents	Parents in stepfamilies	
Crimes in general	29.0% (20/69)	52.4% (11/21)	$\chi^2=3.903$; $P=0.048$
Violent crimes	8.7% (6/69)	33.3% (7/21)	$\chi^2=7.908$; $P=0.005$

families and that perpetrators of parental child homicide have significantly higher incidences of previous crimes than parents in the population in general. Thus, we find support for our first hypothesis.

Next, we want to test the effect of genetic relatedness for the incidence of child homicide. As we have shown, there is a fundamental difference in the risk of committing child homicide between stepfamilies and families with two genetic parents, and stepfamilies consist of both genetic parents and stepparents. Accordingly, we ask whether there are any effects of genetic relatedness between perpetrator and victim within stepfamilies.

In our data set spanning the years 1965–2009 we found 25 stepfamilies where one or more children had been killed and we ask whether, among these families, the risk is higher of a parent killing a stepchild than a genetically related child. In two of the 25 stepfamilies both the stepparent and the genetic parent killed the child victim which means that there were 27 perpetrators altogether. Among these families, 13 parents killed genetically related children, 13 parents killed stepchildren, and one parent killed both a stepchild and genetic children. If we exclude the families with two perpetrators and the family where the perpetrator killed both a genetic and a stepchild there are 22 families with a perpetrator with either genetic or step relationship to the child victim. In these 22 families 11 stepparents and 11 genetic parents were perpetrators. The risk that a stepparent or a genetic parent in a stepfamily kills a child is not significantly different from a 1:1 ratio (Chi-square = 0, $P > 0.99$).

Another way of testing whether a non-genetic relationship between parent and child increases the risk for homicide is to focus on the perpetrator's relationship to the child who was killed in stepfamilies, and analysing only those cases in which the perpetrators had a possible choice between killing a stepchild and killing a genetic child. There were 12 families in our dataset in which the perpetrators had both stepchildren and genetic children in the family (Appendix). In seven of these cases the perpetrator killed a genetically related child and in four cases a stepchild. In one of the 12 cases, the perpetrator killed both a stepchild and genetic children. Hence, the perpetrators in stepfamilies did not preferentially kill stepchildren over genetic children.

Thus, we conclude that we were unable to find support for the hypothesis that genetic relatedness per se has an effect on the risk of parental child homicide.

3 Discussion

Our results show that crime rates are higher among parents in stepfamilies than in families with two genetic parents, both in the general population and among perpetrators of child homicide in our data set. This indicates that parents in stepfamilies have characteristics that can increase the risk for child maltreatment, and we regard our results as support for the hypothesis that the higher incidence of parental child homicide in stepfamilies is an effect of a negative selection into stepfamilies of individuals who have a higher risk, on average, for committing child homicide. This explanation for the higher incidence of child homicides in stepfamilies cannot easily be placed in the classical scheme of ultimate and proximate explanations, but can rather be seen as a confounding or spurious factor that explains the pattern.

It is not surprising that parents in stepfamilies have higher rates of criminality, on average, than parents in families with two genetic parents, considering that people with longer pair bonds are likely to have characteristics that are less "anti-social". Turner et al. (2007, p. 284) suggested that since parents in stepfamilies had a history of employment difficulties and family conflicts before entering a stepfamily "...adults with existing dysfunctions may be more likely to both select into stepfamilies and possess characteristics that increase their children's risk of victimization." Caspi et al. (1994) found an association between delinquency and a personality characterized by low impulse control, and Krueger et al. (2001) and Krueger (2002) found that persons with a criminal record have relatively low impulse control, more intense stress reactions and higher levels of aggression than non-criminal persons. Moreover, also abusive parents have been found to have difficulties with self control (Friedrich and Wheeler, 1982 in Belsky, 1993). These studies, taken together, suggest that the higher rate of parental child homicide in stepfamilies in the present study is best explained by the fact that personality characteristics associated with child maltreatment, as indicated by the higher rates of criminality, are more likely to be found among parents in stepfamilies.

We found no support in our current investigation for the second hypothesis, namely that genetic relatedness influences the risk for a parent of committing child homicide. Thus, among parents in stepfamilies there was no significant difference between the number of parents killing stepchildren and parents killing geneti-

cally related children. Moreover, in the stepfamilies where perpetrators lived with both genetic and stepchildren they did not more often kill stepchildren. In these analyses we selectively targeted stepfamilies because of their higher risk of child homicide as compared to families with two genetic parents, and also because there is no measurable variation with respect to genetic relatedness among families with two genetic parents. Our findings may first seem surprising in the light of kin selection theory, but there are two important points to be made. First, although parents are expected to love and care more for their own offspring than for other young, this does not necessarily translate into risks of homicide. Second, although several studies show that the risk of child homicide is heightened in stepfamilies as compared to families with two genetic parents, this does not prove that the lack of genetic relatedness explains this higher risk.

Our data on parental child homicide did not show an overrepresentation of stepparents as perpetrators in stepfamilies and this suggests that there are other important factors than genetic relatedness that influence the risk for a child to be killed in a stepfamily. There are differences between child abuse and parental child homicide that must be considered in this context. Child abuse is relatively more often the result of a conflict with the child, while child homicide can often be explained in terms of a conflict between the parents (Nordlund and Temrin, 2007). Thus, a large proportion of the homicides are not the result of less "child-specific parental love" (Nordlund and Temrin, 2007), the mechanism suggested to increase the risk for child maltreatment by stepparents (Daly and Wilson, 1988; 1994). Therefore, the Cinderella hypothesis may not be able to explain differential frequencies of parental child homicide among family types.

In conclusion, our results question that there is a Cinderella effect on frequencies of parental child homicide. The result that genetic parents and stepparents were about equally common as perpetrators in stepfamilies indicates that non-genetic relatedness between parent and child is not the primary explanation for a relatively high frequency of parental child homicide in stepfamilies. However, our sample of stepfamilies is limited in size and in order to find out whether the results of the present study have a general relevance, we suggest that data sets from other countries are exposed to the same hypothesis testing as has been done in the present study. Thus, it would be interesting to find out whether the higher incidence of child homicide in step-

families can generally be attributed to the effect of selection of parents with certain characteristics into such families (a confounding factor) and/or a lack of genetic relatedness to the victim, i.e. an ultimate/evolutionary explanation.

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Appendix Age (years) of genetic children (G) and stepchildren (S) in 12 families where the perpetrator had a mixed relationship to children A

Age S	Age G	Suicide
5	0.3	N
13	8; 5; 4	Y
>5	5	Y
1.5	0.2	N
>2	2; 0.1	N
7; 8	0.8	N
6	1	Y

B

Age S	Age G	Suicide
6	0.5	Y
11	7; 2	N
4	0.5	N
12; 13	8; 6; 1	Y

Note. In one stepfamily, not listed above, the parent killed both a stepchild (5 years) and two genetic children (3 and 1 years). In two cases of stepchildren in A) the exact age of the children is not known, only that they are older than the child-victim.

A. Seven families where a genetic child was killed (**G**). **B.** Four stepfamilies where a stepchild was killed (**S**). Perpetrator suicide is noted by Y (yes) or N (no).