

Early childcare and physical aggression: differentiating social selection and social causation

Anne I.H. Borge,¹ Michael Rutter,² Sylvana Côté,³ and Richard E. Tremblay³

¹University of Oslo, Norway; ²Kings College, London, UK; ³University of Montreal, Canada

Background: Some research findings have suggested that group day-care may be associated with an increased risk for physical aggression. **Methods:** Cross-sectional maternal questionnaire data from a representative sample of 3431 Canadian 2- to 3-year-olds were used to compare rates of physical aggression shown by children looked after by their own mothers and those attending group day-care. A family risk index (using occupational level, maternal education, size of sibship, and family functioning) was created to test whether any difference in physical aggression might reflect social selection rather than social causation. **Results:** Aggression was significantly more common in children looked after by their own mothers than in those attending group day-care. Strong social selection associated with family risk was found, not only in the sample as a whole, but even within the high-risk subsample. However, after taking social selection into account, physical aggression was significantly more common in children from high-risk families looked after by their own parents. No such difference was evident in the majority (84%) of children from low-risk families. **Conclusion:** Insofar as there are any risks for physical aggression associated with homecare they apply only to high-risk families. **Keywords:** Physical aggression, family, risk, homecare, day-care, toddlers, social selection, social causation, age, gender.

Some half-century ago, major concerns were first raised about the supposed mental health risks associated with group day-care (Bowlby, 1951; WHO Expert Committee on Mental Health, 1951). Over the next three decades, small-scale studies indicated that the risks had been greatly exaggerated, and reviews (see, e.g., Rutter, 1981) concluded that any effects were likely to be dependent on both the quality of day-care and the quality of care in the child's own home. Since then, far more data have become available through systematic large-scale studies such as that undertaken by the US National Institute of Child Health and Human Development (NICHD Early Child Care Research Network, 1998). It might be expected that all controversies should have been resolved by now, but it is clear that that is far from the case (see, e.g., Belsky, 2001; Clarke-Stewart & Allhusen, 2002; Lamb, 1998).

One key issue concerns the need to differentiate between social selection and social causation effects (Caspi, 2002; Dohrenwend et al., 1992; Rutter, Pickles, Murray, & Eaves, 2001). Psychosocial environments are far from randomly allocated in the general population (Rutter, Champion, Quinton, Maughan, & Pickles, 1995) and day-care is no exception to that general rule (Clarke-Stewart & Allhusen, 2002). The extent to which families make use of group day-care will be influenced by whether or not both parents work outside the home, by attitudes to day-care, and by the availability of day-care provision, as well as by the family's ability to pay if free care is not available. Because there are substantial national and regional variations in all of these features (Borge, Hartmann, & Strøm, 1994), it cannot

be assumed that social selection will operate in the same way in all populations.

A further need is to determine whether childcare effects are the same throughout the population or, rather, function differentially in subgroups. Thus, for example, it might be thought that, when home circumstances are very poor, good quality day-care might be a preferable option. Perhaps, it could compensate to a degree for marked family adversity (Clarke-Stewart & Allhusen, 2002; Prodromidis, Lamb, Sternberg, Hwang, & Broberg, 1995; NICHD Early Child Care Research Network, 1998; Scarr & Thompson, 1994). Alternatively, if group day-care carries mental health risks, such risks might be greater if the children are also experiencing a risk environment at home (Lamb & Sternberg, 1990; NICHD Early Child Care Research Network, 1997, 1998).

Many of the earlier concerns over group day-care centred on the possible risks to secure attachment. However, especially in recent times (see Belsky, 2001), concerns have shifted to supposed effects on aggression. This arises in part because group day-care most obviously differs from homecare in the fact that the children spend their time in a broader peer group. On the one hand, this could provide more opportunities for physical aggression to arise. On the other hand, this might also mean that the children in group day-care have more opportunities to learn how to resolve interpersonal conflict without recourse to hitting and fighting. The focus on physical aggression as a possible consequence of early childcare also derives from a growing awareness that such behaviour both peaks in the

preschool years and constitutes a major risk factor for the later antisocial behaviour (Tremblay, 2000; Tremblay et al., 1999).

Ordinarily, any hypothesis on environmentally mediated risk effects is best tested through some kind of experimental or quasi-experimental design that involves the use of longitudinal data. The point is that causal effects can be examined more directly through examination of within-individual change over time in relation to the postulated risk experience, than through the indirect test of between-group comparisons (Loeber & Farrington, 1994; Rutter et al., 2001). However, these experiments are still infrequent, especially during early childhood (Tremblay & LeMarquand, 2001); are problematic in the case of group day-care that begins in infancy and are impossible in the case of family care that has been present since birth. Physical aggression pre-care cannot be assessed when care begins in the neonatal period or in the very early months of life. Even with care that begins in the second year of life, it is dubious whether measures of physical aggression at the age of, say, 12 months have the same meaning (or predictive value) as those at later ages. There needs to be caution in any such assumption in view of the limited predictive value of temperamental measures in infancy (Kohnstamm, Bates, & Rothbart, 1989; Thomas & Chess, 1977), as compared with their very much greater stability and predictive validity in relation to psychopathology by the age of 3 years (Caspi, Henry, McGee, Moffitt, & Silva, 1995). Accordingly, reliance needs to be placed on between-group comparisons, making cross-sectional studies a reasonable design choice at this point in time.

Most studies of early childcare have focused on the qualities of group day-care in the home and there has been less attention to the possible circumstances under which family care may carry risks; the main focus of the present paper. Although it has become standard to examine the effects of group day-care after controlling for family background, there has been less attention to the details of social selection and almost no attention to the possibility that the effects of family homecare may vary systematically according to family characteristics. However, a recent paper by Jaffee, Moffitt, Caspi, and Taylor (in press) with respect to the effects on conduct problems at age 5 years of fathers' involvement in childrearing clearly indicates the importance of the issue. When the fathers were not antisocial the effects of their involvement were beneficial but when they were antisocial, the effects were negative. Similarly, it may be hypothesised that the effects of family homecare on aggression in early childhood may be either beneficial or risky according to the absence or presence of family risk. Accordingly, there was a need for analyses that examine effects in separate segments of the population that differ in family risk features.

In order to differentiate between social selection and social causation, as well as to test for possible differential effects of childcare according to the extent of family adversity, four requirements must be met. First, a large sample is essential. Second, it must be representative of the general population. Third, there must be adequate measures of family risk of a kind that are unlikely to be secondary to the type of care provided. Fourth, there must be measures of physical aggression that are not just reflecting non-aggressive disruptive behaviour. The Canadian National Longitudinal Survey of Child and Youth (NLSCY) meets these requirements and, in this paper, we report the findings on 2- to 3-year-olds.

Method

Sample

In 1994, a random sample of 15,579 Canadian households with at least one child aged 0 to 11 years was selected from Statistics Canada Labour Force Survey for a longitudinal study of children's development, the National Longitudinal Survey of Children and Youth (NLSCY) (Human Resources Development Canada & Statistics Canada, 1996). Response was obtained for 13,439 of these selected households; an overall response rate of 86.3%. Data collection was undertaken by a single home interview with the person most knowledgeable about the child (PMK) in the fall of 1994 and spring of 1995; in 89.9% of the cases the PMK was the mother. Other details about the study can be found in Statistics Canada and Human Resources Development Canada (1995). Additional children in the same economic family were selected at random for a maximum of four children aged 0 to 11 per household. From the 22,831 children aged 0 to 11 years of age, in 13,439 households, we selected all children between 24 and 47 months of age ($n = 3809$). Due to missing data, the analyses were conducted on 3431 subjects. Among these subjects, 141 (4.1%) families reported on two children while the rest, 3290 families, reported on only one child. Because non-independence arising from two children in the same family affected such a very small proportion of the sample, it was not taken into account in the data analysis.

Measurement of variables

Dependent variable: Frequency of physical aggression was measured with three physical aggression items with high internal consistency (see Baillargeon et al., 2001; Cairns, Cairns, Neckerman, Ferguson, & Gariepy, 1989; Nagin & Tremblay, 1999). The interviewer asked the PMK how often (never, sometimes, often) the child behaved in the following way: a) kicks, bites and hits other children; b) when another child accidentally hurts her/him she/he reacts with anger and fighting; and c) gets into many fights. These three questions were scored as 0, 1 or 2 and summed to create a scale ranging from 0 to 6 (Cronbach's alpha = .84). The NLSCY data indicated that girls from 2 to 11 years of age

consistently made less use of physical aggression than their male counterparts (Tremblay et al., 1996). However, the use of different scores for boys and girls could only be justified if the measurement of aggression meant different things in the two sexes. That is not the case (see Moffitt, Caspi, Rutter, & Silva, 2001). The main focus was on those scores that were sufficiently high to give rise for some concern. Thus, the cut-off was set at score 4 and above for both boys and girls. The extreme group was 6.4% of the total sample, respectively 148 (8.1%) of the boys and 72 (4.4%) of the girls. High physically aggressive boys and girls needed to have been rated 'often' on at least one of the physical aggression items, and at least 'sometimes' on the other two.

Independent variables: Sample characteristics on the independent variables are summarised in Table 1. Child age groups and sex were described among family and day-care parameters. Number of siblings from 0 to 18 years of age living in the child's household was obtained from the PMK. The size of sibship was categorised into four groups, respectively 0 siblings, 1, 2 or 3 and more. The highest level of maternal education attained at the time of the interview was classified in the following four categories: less than secondary school,

secondary school diploma, some education beyond high school, and college or university diploma.

A family assessment scale of 12 items measured the quality of family functioning (communication, problem resolution, control of disruptive behaviour, showing and receiving affection) (Boyle et al., 1987). The scores ranged from 0 to 30 on the scale. To obtain a variable with scale properties similar to other independent variables the scores were grouped into four categories ranging from very poor to very good family functioning. Each family was also classified according to four socio-economic categories based on parents' education, occupational status and household income (Willms & Shields, 1996). The highest category was made up of those at least 1 *sd* below mean and conversely, the lowest category of those at least 1 *sd* above mean (i.e., high scores reflected worse family functioning).

The interview manual provided 10 alternatives for types and contexts of care. In order to focus on the possible risks and benefits associated with homecare in the family, type of care was dichotomised. Homecare ($n = 1961$) represented all children cared for at home by their mother. Day-care ($n = 1470$) included all other alternative forms for care.

Table 1 Demographic characteristics

	<i>n</i> = 3431	(%)
Age		
24–35 months	1760	(51.3)
36–47 months	1671	(48.7)
Sex		
Girls	1601	(46.6)
Boys	1830	(53.4)
Siblings		
No siblings	958	(27.9)
1 sibling	1591	(46.4)
2 siblings	621	(18.1)
3 or more siblings	261	(7.6)
Maternal education		
Less than secondary school	518	(15.1)
Secondary school diploma	574	(16.7)
Beyond high school	953	(27.8)
College or university degree	1386	(40.4)
Family functioning		
Very poor functioning	620	(18.1)
Poor functioning	1052	(30.6)
Moderately good functioning	897	(26.2)
Very good functioning	862	(25.1)
Socioeconomic status		
Very low socioeconomic status	360	(10.5)
Low socioeconomic status	1489	(43.4)
Medium socioeconomic status	1270	(37.0)
High socioeconomic status	312	(9.1)
Type of child care		
Homecare	1961	(57.2)
Day-care	1470	(42.8)
Types of care attended since birth		
1 type	1070	(72.8)
1 or more types	400	(27.2)
Stability of type of care during last 12 months		
No change	1113	(75.7)
1 or more changes	357	(24.3)
Hours per week attended at present type		
Fewer than 35 hours per week	780	(53.1)
35 hours and more	690	(46.9)

Statistical analysis

The analysis needed to start with an overall comparison of homecare and alternative day-care groups with respect to the rate of unusual physical aggression. Unexpectedly (see below), aggression was found to be more common in the homecare group. Analyses thereafter focused on the need to differentiate social selection and social causation and to determine whether the higher rate of physical aggression in children receiving homecare applied only within particular subgroups.

The question of possible social selection was tackled by focusing on variables that had significantly different rates in the homecare and day-care groups, and had a significant association with physical aggression. Four family risk variables met both criteria: family socioeconomic status, maternal education, sibship size and quality of family functioning. The effects of these four variables on the group difference in physical aggression were then examined.

The score of these four variables was scaled in the same way with an equal number of points so that the higher the score, the higher the risk. Thus, high scores referred to low socioeconomic status, low educational attainment, large sibship (family) size, and poor family functioning. The intercorrelation between socioeconomic status and maternal education was substantial (.60), but otherwise the intercorrelations were all low (.02 to .22).

Although family functioning did not reach a significant level of association with type of care in the overall sample, it did have a significant association within the high-risk subsample and a significant effect on physical aggression. Hence, it was retained in the group of four family risk variables.

The only other variable that might have been important in social selection was gender, because physical aggression was nearly twice as common in males. However, there was no significant difference between the homecare and day-care groups in the proportion of

boys (52.1% in homecare vs. 55.1% in day-care) so that there was no indication that it played any role in selection into different types of care. It was not, therefore, considered further in the initial analyses, but both age and gender were examined for possible moderating effects.

The first approach to differentiating social selection and social causation involved a subdivision of the total sample into two overall low-risk and high-risk groups. Because of the low intercorrelations among the risk variables, the dichotomisation was based upon a cut-off of the four variables focusing on the extreme point that caused most risk, i.e., lowest level of maternal education, 3 siblings and more, lowest socioeconomic status and very poor family functioning. The high-risk group was defined in terms of being in the highest-risk extreme point on any of these risk variables, whereas the low-risk group was not on this point for any of the four variables. The difference in aggression between children in homecare versus day-care was tested within the high-risk group and low-risk group by use of cross-tabulations showing the proportions of children within the various subgroups.

Because the day-care/homecare choice showed such a strong social selection effect with respect to family risk, it was necessary to go on to consider whether there was a selection effect within the high-risk group. In order to examine that possibility, the four family risk variables were composited to provide an overall score with a range from 0 to 12. This was used to provide a median split between those in the top and bottom halves of high risk. The proportions of children with physical aggression in the homecare and day-care groups within these subgroups were determined in the same way as under step one, by cross-tabulations.

An overall regression model tested the effect of homecare versus day-care within the upper high-risk group once social selection was taken into account. The family risk composite was treated as a dimension and put into a regression with aggression as the dependent variable. With that exception, almost all analyses of the effects of homecare versus group day-care used categorical rather than dimensional variables. Although it has been argued that it is desirable to deal with dimensions rather than categories because of the greater statistical power provided (MacCallum, Zhang, Preacher, & Rucker, 2002), there are powerful counterarguments (Farrington & Loeber, 2000). Dichotomisation produces meaningful findings that are more readily understandable, and that give a more realistic measure of the strength of association. Most especially, they allow examination of nonlinear relationships and a better opportunity to study interaction effects. As these features were critical to the study of early childcare, dichotomisation procedures constituted our preferred mode of analysis.

Results

Table 1 summarises the demographic characteristics of the sample. There was an approximately equal number of 2-year-olds and 3-year-olds, but there was a slight excess of boys. Just over a quarter of the sample had no siblings, close to a half had one sib-

ling, nearly one in five had two siblings and one in twelve came from a sibship of three or more. One in six mothers had not finished secondary school, about the same proportion had completed secondary school, just over a quarter had some education beyond high school and two out of five had a college or university degree or diploma. Nearly a fifth of the sample showed very poor family functioning, nearly a third poor functioning, but a quarter showed good functioning and another quarter very good. Socioeconomic status was very low for 1 in 10 of the families; was low in just over two-fifths, medium in over a third and high in 1 in 11.

More than half of the 2- and 3-year-olds had not attended any alternative setting to maternal care. Among the day-care children, about three-fourths had attended only one type of day-care since birth whereas just over a quarter had attended two types or more. Similarly, three-quarters of the children had experienced no change in type of care during the last 12 months. About half of the children spent less than 35 hours per week in day-care.

Overall, the proportion of children with high physical aggression was nearly one and a half times as high in the homecare group as in the day-care group (7.4% vs. 5.2%; $\chi^2 = 7.1$, 1 *df*; $p = .008$). A similar (but small) group difference was evident when physical aggression was treated as a dimension. The mean in the homecare group was 4.20 (*sd* 1.4) as compared with a mean of 4.03 (*sd* 1.2) in the day-care group, a significant difference ($t = 3.84$; $df = 3,429$, $p = .001$). The remainder of the analyses were designed to determine what this group difference in rates of physical aggression might mean.

Table 2 summarises the bivariate correlational (point biserial r_{pb}) coefficients between physical aggression and type of care in relation to four family risk factors. The four variables were scaled all in the same way: the higher the score, the higher the risk. Physical aggression was scored as low '0' and high '1'. Consequently, any result showing associations between high risk on a parameter and high physical aggression would be in the form of a positive correlation coefficient. High physical aggression was associated with low maternal education ($r_{pb} .07$), high number of siblings ($r_{pb} .09$), low socioeconomic

Table 2 Bivariate correlations (r_{pb}) between physical aggression, type of care and family risk factors ($n = 3431$)

	Physical aggression Low '0' High '1'	Type of care Homecare '0' Day-care '1'
Maternal education	.07	-.23
Sibship size	.09	-.20
Socioeconomic status	.09	-.22
Family functioning	.08	-.03 ¹
Overall high-risk group	.12	-.17

¹All correlations were significant; $p < .001$ except $r_{pb} = .03$; $p = .08$.

status ($r_{pb} .08$) and very poor family functioning ($r_{pb} .08$). Homecare was significantly associated with three of the four risk factors within a range from $r_{pb} - .20$ to $r_{pb} - .23$. The association between family functioning and type of care $r_{pb} - .03$ fell just short of significance, $p < .08$. At first sight, the significant correlations between the family variables and physical aggression appear very low but these reflect the numbers in key cells. The odds ratios for the four family variables were 2.1, 2.4, 2.0 and 2.3 respectively. As a precautionary check, the analyses were repeated using Spearman rank coefficients; the findings were almost identical, with exactly the same correlations statistically significant.

Table 3 shows the proportions of children with low and high physical aggression in homecare and day-care subsamples within the low family risk group ($n = 2156$) and high family risk group ($n = 1275$). The findings located where the difference between homecare and day-care resided. In the low family risk sample there were the same low proportions (4.1%) of children with high physical aggression in the day-care and homecare subsamples. However, within the high family risk sample ($n = 1275$) significantly more children in homecare than in day-care were physically aggressive, 11.5% vs. 7.9%, ($\chi^2 = 4.24$; $p = .04$).

Table 4 shows the results from the second step in the family risk analyses whereby the high-risk sample ($n = 1275$) was split into a lower half ($n = 735$) and an upper half ($n = 540$). The difference in the proportions of children showing high physical aggression continued to differ even within the extreme range of family risk but not within the lower half. In the lower half of the high family risk sample ($n = 735$) there were again similar proportions of children rated with aggression in homecare and day-care; 9.5% vs. 9.2%. In the upper half of the high family risk sample, one in seven of the children in

homecare were rated as showing high aggression, whereas only 3% of the day-care children were similarly rated. A logistic regression analysis showed that the interaction between family risk and family care with respect to effects on physical aggression was statistically significant ($p = .014$). Expressed another way, the difference between the OR of 5.01 (CI = 1.54 to 16.32) ($n = 540$) in the upper high-risk group and the OR of 1.08 (CI = .78 to 1.49) ($n = 2891$) in the remainder of the sample was also statistically significant, because the two confidence intervals do not overlap ($t = 2.46$; $p = .014$). That is, both analyses showed a significant interaction whereby there was a substantial effect of homecare on physical aggression in the children from a socially disadvantaged background but no effect in those from lower-risk families.

Analysed dimensionally, the mean aggression score in the homecare group was 4.39 ($sd = 1.60$) compared with 3.85 in the day-care group ($sd = 1.09$) – a highly significant difference ($t = 3.20$; $p = .001$). However, it is apparent that there was also a substantial social selection effect; whereas 50.5% (440/870) of the homecare sample were in the upper high-risk group, only 24.7% (100/405) of the day-care sample were in that segment.

Because the social selection effect was still strongly operative within this high family risk subsample (representing 15.7% of the general population), it was necessary to undertake a multivariate analysis to determine if, within this subgroup, there was still a homecare/day-care group difference once social selection had been taken into account. This was undertaken by means of an analysis of covariance, treating the dimension of composite family risk as the covariate, and the dimension of physical aggression as the dependent variable. This showed that there was a residual significant effect of homecare on physical aggression, $F(2537) = 6.58$, $p = .001$. The

Table 3 Proportions of children with physical aggression in families with low or high risk and type of day-care ($n = 3431$)

Physical aggression	Type of care		Total <i>n</i> (%)
	Homecare <i>n</i> (%)	Day-care <i>n</i> (%)	
Low family risk			
High aggression	45/1092 (4.1%)	44/1064 (4.1%)	89/2156 (4.1%)
	1092	1064	
	$\chi^2 = 0.002$; $df = 1$, $n = 2156$, $p = .96$		
High family risk			
High aggression	100/869 (11.5%)	32/406 (7.9%)	132/1275 (10.4%)
	$\chi^2 = 4.24$; $df = 1$, $n = 1275$, $p = .04$		
	1961	1470	3431

Comparing groups on aggression, 7.4% (145/1961) highly aggressive children in homecare vs. 5.1% (75/1470) in day-care ($\chi^2 = 7.1$; $df = 1$; $p = .007$).

Comparing level of risk in relation to aggression, 10.4% (132/1275) highly aggressive children in the high-risk group vs. 4.1% (89/2156) in the low risk group ($\chi^2 = 51.5$; $df = 1$; $p = .001$).

Comparing groups on level of risk, 44.3% (869/1961) of the homecare group showed high family risk as compared with 27.6% (406/1470) in the day-care group ($\chi^2 = 100.9$; $df = 1$; $p = .001$).

Table 4 Proportions of children with physical aggression in the lower and upper half of families high risk and type of day-care ($n = 1275$)

	Type of care		
	Homecare <i>n</i> (%)	Day-care <i>n</i> (%)	Total <i>n</i> (%)
Physical aggression			
Lower half of high family risk			
High aggression	41/430 (9.5%) $\chi^2 = .02$; $df = 1$, $n = 735$, $p = .89$	28/305 (9.2%)	69/735 (9.4%)
Upper half of high family risk			
High aggression	59/440 (13.4%) $\chi^2 = 8.48$; $df = 1$; $n = 540$, $p = .001$	3/100 (3%)	62/540 (11.5%)
	870	405	1275

Comparing groups in relation to aggression, 11.5% (100/869) in homecare vs. 7.7% (31/405) highly aggressive children in day-care ($\chi^2 = 4.24$; $df = 1$; $p = .04$).

Comparing level of aggression according to family risk, 11.5% (62/540) of the children in the upper high-risk group showed aggression compared with 9.4% (69/735) in the low risk group ($\chi^2 = 1.48$; 1 df ; $p = .22$).

Comparing level of risk in relation to groups, 50.5% (440/870) of children in homecare were in the upper high-risk group compared with 24.7% (100/405) of the children in day-care ($\chi^2 = 76.0$; 1 df ; $p = .001$).

adjusted means for the homecare and day-care groups were 4.37 and 3.86 respectively, representing a difference of a third to a half of a standard deviation. By contrast, the preceding analyses had shown no effect of homecare in the majority 84.3% of the general population sample. It is notable that if the same analysis of covariance procedure is followed in the total sample, the adjusted means are 4.18 vs. 4.05 – a very much smaller difference, confirming that the effects of homecare on physical aggression are confined to a small minority subgroup with high family risk.

Possible moderating effects of age and gender

As was to be expected, physical aggression was significantly more common in boys than girls in the sample as a whole – 8.1% vs. 4.4% ($\chi^2 = 19.5$; $df = 1$; $p < .001$). Aggression was also significantly more common in 3-year-olds than in 2-year-olds (7.5% vs. 5.5%; $\chi^2 = 5.84$; $df = 1$; $p = .016$). In relation to the aims of the study, the need was to determine if either age or gender moderated the effect of homecare on physical aggression. This was examined through logistic regression analyses undertaken, first, on the total sample and, second, on the high-risk sample of 1275. In neither case was there a significant interaction between gender and homecare, or between age and homecare. Thus, in the high-risk sample, the regression analysis showed a significant effect of homecare ($p = .006$), of gender ($p = .009$) and of age ($p = .003$) but statistically non-significant effects for the interaction between homecare and gender ($p = .155$) and between homecare and age ($p = .07$). The non-significant trend for the moderating effect of age was even less significant ($p = .577$) in the total sample and also went in the opposite direction, so that it is most unlikely that there was a valid moderating effect.

Discussion

Our main analyses have focused on the apparent possible risk for physical aggression associated with homecare compared with day-care. The results show (1) that social selection factors were strong; and (2) that there was no indication of social causation within the majority low-risk segment of the population. The homecare and day-care groups differed strikingly with respect to family risk and this difference kept recurring even when the sample was restricted to higher family risk groups. There was no tendency, not even a weak trend, for physical aggression to be associated with homecare in the large majority of the general population at lower family risk. Nevertheless, despite the strong effect of social selection, once this had been taken into account, there was a residual significant association between homecare and physical aggression within the subsection of the population at the highest level of family risk. It is necessary to consider, therefore, whether the social selection effect was valid; whether the lack of effect of homecare in the majority low-risk sample was valid; whether the apparently adverse effect of homecare on physical aggression in the very high-risk subsample was valid; and, if valid, what it might mean.

There is every reason to suppose that the social selection effects of family risk were both real and important. Whether family risk was assessed according to an extreme on any one of the four family risk variables, or according to a mean score on a composite representing a sum of the four family features, the selective effects were strong and highly statistically significant. Clearly, socioeconomic status and maternal education were family features that preceded any decision on pattern of care and could not have been affected by it. Families might decide to have another child on the basis of the

availability of group day-care but it seems implausible that they would do so on the grounds of its absence. It is possible, although not likely, that family functioning could have been affected by the childcare experience, but the selection effects were least evident on this variable and the same strong effects of social selection were evident when family risk was assessed with or without the family functioning measure. Nevertheless, it should not be assumed that the same type of social selection will be found in all populations. The conclusion is not that it works in one particular way but, rather, that the hypothesis of social causation effects (with respect to childcare or to any other psychosocial experience) cannot be examined without careful attention to social selection influences.

It is noteworthy that, although statistically significant, the effects of family risk on physical aggression were substantially weaker than the effects on pattern of childcare. In that connection, it is almost certainly relevant that the family features were of a kind that were likely to be more directly implicated in the decisions involved in choice of pattern of childcare than in the causal processes involved in liability to aggression. There is some evidence that having a sibling is associated with a higher risk of physical aggression in early childhood (Tremblay et al., 1996), and poor family functioning might also play a role in the mechanisms underlying high levels of aggression (Tremblay et al., 1999; Tremblay et al., 2002). However, that is unlikely to be the case with either socioeconomic status or maternal education. Rather, it must be assumed either that they have a more distal connection with risk or that they simply serve as crude risk indicators as a result of their association with other (unmeasured) family risk variables (see Nagin & Tremblay, 2001). Accordingly, no claims are possible on the true strengths of environmentally mediated effects of family risk on physical aggression. The findings certainly show some effect but little can be said on its strength and even less on the key mediating family feature.

Is the lack of effect of pattern of childcare on physical aggression within the majority low family risk sample likely to be valid? There is no reason, theoretical or empirical, to doubt the reality of the lack of effect of homecare within this group but it is necessary to question the apparent lack of risk associated with group day-care in view of contrary findings in the NICHD study (Belsky, 2001; NICHD Early Child Care Research Network, 2002). Several possibilities have to be considered. First, our measure of physical aggression was based on just 3 items whereas the NICHD measure had 6 items. On the other hand, ours was a 'purer' measure of physical aggression (the NICHD measure included sudden changes of mood and explosive behaviour). Our cut-off picked out a more extreme group (6.4% of the sample as compared with 16% in the NICHD study),

but the results were broadly similar if aggression was dealt with as a dimension. Second, whereas the NICHD had a substantial (40%) non-participation rate, raising the possibility of major bias, our sample involved a much lower rate of attrition, 13.7%, and therefore of less possible bias. Third, our findings concern 2- to 3-year-olds whereas the NICHD findings apply to 4 1/2-year-olds. We conclude that there is no good reason to doubt the lack of risk of homecare in the majority low family risk subgroup. The NICHD found the same. It is necessary, on the other hand, to be more cautious about our finding of a lack of risk for physical aggression associated with early group day-care. Within our own data set, there is no reason to doubt the reality of the negative finding, but we had much weaker measures than NICHD on the qualities of day-care (and no data on when day-care began). Accordingly, our negative finding can only be used to raise a query on the generality of the NICHD finding and on the need for replication in different samples.

Similar questions need to be raised about the validity of our finding that, within a high family risk group, homecare was more likely than day-care to be associated with physical aggression. The continuing operation of social selection even within this high-risk group clearly underlines the close connection between the risks of physical aggression associated with homecare and the presence of family risk or adversity. It may be inferred that homecare constitutes a risk for aggression only if the child's home circumstances are markedly disadvantageous. Does group day-care protect against aggression in these circumstances? Our data suggest that it might do so – possibly because it 'dilutes' the child's exposure to family risk or possibly because it provides positive learning opportunities that are not so readily available at home. Despite the fact that our initial sample was over 3000, the number of children at very high family risk was rather small for any critical examination of protective effects. They are certainly possible and it is desirable that future research test for the possibility, but that is as much as can be said at the moment.

Could the risks for aggression associated with homecare represent a rating bias or artefact? That possibility requires serious consideration for two rather different reasons. First, mothers looking after their children at home necessarily have a more extended opportunity to observe their children behaving aggressively than do mothers whose children spend many hours of the day in group day-care. Once evenings and weekends are taken into account, the time difference is less than might at first sight be supposed (Scarr, Phillips, & McCartney, 1990); nevertheless it exists. Even so, it is most unlikely that this constitutes the explanation. If it were, a homecare/day-care difference would be expected at all levels of family risk and that is not at all what was found. It was present only in children from high-risk

families. A second possibility is that mothers from a disadvantaged background, or bringing up a large family of children, may be inclined to 'over-rate' aggression as compared with other mothers. The only satisfactory way to test that suggestion would be to use some other measures of aggression. They will be obtained for our sample as the children enter school but they are not currently available. Nevertheless, again, this explanation lacks plausibility. If it were operative, it would be expected that mothers from a disadvantaged background whose children attended day-care would similarly 'over-rate'. But that is not at all what was found.

In formulating the questions to be tackled in the paper, we pitted the possibilities of social selection and social causation against one another. The findings clearly showed the strong effect of social selection. That is, the mothers who provided homecare throughout the first 3 years differed systematically from those who used group day-care outside the home – in being less well educated, in being in a lower occupational group, in having a larger number of children and in showing less adaptive family functioning. Nevertheless, even when this social selection effect was taken into account, children from high-risk families who received homecare were more likely to show physical aggression than those in day-care outside the family. Family risk, as measured with the variables available to us, did not, however, entirely mediate the effects on aggression because the family care effect in the high-risk group remained after controlling for family risk, and because family risk was not associated with physical aggression in the day-care group. It remains, therefore, to consider whether the family care effect represented social causation. We have shown that the association is unlikely to represent either bias or chance, but does it represent environmentally mediated causation? Clearly, it is not likely that family care as such provides an environmentally mediated risk for aggression. Rather the implication is that, if there is social causation, it is probably that it derives from some type of disadvantageous parenting provided in the high-risk sub-segment of the population. Two main alternative explanations need to be considered. First, the family risk measure could index genetic risk. Twin studies could help test that possibility (see Rutter et al., 2001). Second, it could be that the family decision not to use group day-care was a consequence of the child showing early disruptive behaviour. The lack of any moderating effect of age makes that a weak suggestion but the possibility cannot be tested within the available data set. For obvious reasons, longitudinal data on our sample cannot provide a decisive answer because the family homecare was provided from birth and because we cannot assess onset of physical aggression in children already showing aggression. On the other hand, longitudinal data would be informative in determining whether currently aggressive children are more

likely than non-aggressive children to continue with homecare after age 2 to 3 years, and whether the later provision of group day-care is associated with a diminution in physical aggression among children from high-risk families. We will be undertaking such analyses in the near future using the follow-up data on this sample. In the meanwhile, our findings point to the need to consider the possibility of environmentally mediated risks for aggression associated with some aspect of parenting in high family risk samples.

Finally, it is necessary to ask whether ratings of physical aggression at the early age of 2 to 3 years have any long-term implications. Clearly, it would be unwarranted to read much into a single cross-sectional finding from a single informant. On the other hand, other studies have shown that high levels of physical aggression exhibit substantial stability even in early childhood (Cummings, Iannotti, & Zahn-Waxler, 1989; Hay, Castle, & Davies, 2000; Keenan & Shaw, 1994; Tremblay et al., 2002). Accordingly, it would be equally unwise to suppose that the finding is of no consequence. The longitudinal data from the study that will be available in the future will indicate just how significant the longer-term implications are.

The main research message from our findings is the reaffirmation of the crucial importance of taking social selection into account when seeking to study social causation. The main clinical message is that, in considering the possible risks associated with group day-care, there is a danger that we overlook the risks associated with the homecare of children in socially disadvantaged families under stress. More thought will need to be given to the pattern of childcare provided for children living in such high-risk families. It is necessary to ask what are the circumstances under which group day-care decreases the risk and what are the circumstances under which it increases it. Our findings suggest that the possibility of protective effects warrants further study, with attention to the mediating mechanisms that could be involved.

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Correspondence to

Anne I.H. Borge, Department of Psychology, University of Oslo, P.B. 1094 Blindern, N-0317 Norway; Email: a.i.h.borge@psykologi.uio.no; or to Michael Rutter, Box Number P080, Institute of Psychiatry, De Crespigny Park, Denmark Hill, London SE5 8AF, UK. Email: j.wickham@iop.kcl.ac.uk

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