

## CURRENT TOPIC

## Out-of-home day care and health

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The latter half of the twentieth century has witnessed some striking changes in social fabric of British children's lives. The proportion of births outside marriage has increased dramatically, from 5% in 1960 to 30% in 1991.<sup>1</sup> There are currently over one million lone parent families in Britain, nearly a fifth of all families with children. The number of mothers with children under 5 who work outside the home has also increased, by more than 15% in the 1980s alone.<sup>1</sup> None of these changes are unique to Britain and similar demographic processes have taken place throughout Europe. However, unlike many continental European countries, where the predominant social policy response to these changes has been the wider provision of out-of-home day care, in Britain day care provision remains scant, essentially little more than a remedial measure for the most disadvantaged of children. For example, while Denmark provides publicly funded day care places for 48% of children under 3, the corresponding figure for Britain is 2%.<sup>1</sup> Surprisingly, the voice of paediatricians, traditional advocates for children, has been uncharacteristically silent in the political debates surrounding child care. The aim of this paper is to critically review the effects of out-of-home day care on child health. Because the validity of evidence from randomised controlled trials is far more readily assured than with other study designs, particular emphasis is given to evidence from randomised experiments.

**Intellectual development**

The effect of day care on the intellectual development of children has been examined in observational and experimental studies. The results of cohort studies show that children who attend out-of-home day care score at least as high and usually higher in tests of intellectual ability than do children who are cared for at home.<sup>2</sup> However, the potential for confounding presents a potent threat to the validity of results from observational studies. There is some evidence that the parents of children in day care value education more highly and provide more intense stimulation to their children.<sup>2</sup> As a result, the observed effects of out-of-home day care may be confounded by the effects of parental educational input. Because of the potential for confounding in observational studies, the evidence from experimental studies is particularly important.

Four large randomised controlled trials have examined the effects of out-of-home day care on childhood development. The earliest of these, the Perry preschool project, was initiated in Michigan in 1962.<sup>3</sup> The study followed up 123 disadvantaged black children who at ages 3 and 4 were randomly allocated to an experimental group that received 2.5 hours of centre based preschool education per day for two years, or to a control group that received no preschool training. At school entry, the mean IQ of the experimental group (94) was significantly higher than that of the control group (83).

A second study, the Carolina Abecedarian project, examined the effect of educational day care on the intellectual development of children considered to be at high risk for mental retardation.<sup>4</sup> One hundred and twenty children were randomised to a day care intervention or a control group. Day care started when children were between 6 and 12 weeks of age and the children attended day care five days a week, 50 weeks per year. Intellectual development was assessed every six months using standard tests. At 54 months, complete follow up information was available for 72% of randomised subjects. Positive effects of day care on IQ were evident at all ages. After controlling for maternal mental retardation and the effects of the home environment, the mean IQ of the experimental children ranged from 7.9 to 20.1 points higher than that of the children in the control group.

A sequel to this study was conducted by the same investigators. Project CARE was designed to examine the effect of educational day care plus family support on the intellectual development of children at risk for cognitive difficulties.<sup>5</sup> Sixty five children were randomised at birth to either family education and centre based care, family education alone, or no intervention. The children who received centre based care scored higher on the Bayley scales of infant development, the Stanford Binet intelligence scale, and the McCarthy scales of children's abilities than did those in the other two groups. There were no cognitive gains in the group of children receiving family education alone.

The largest trial to date, the North American Infant Health and Development Program, examined the efficacy of an early intervention package comprising home visitation, educational day care, and parent support in reducing developmental delay among low birthweight

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premature infants.<sup>6</sup> The intervention program was initiated on hospital discharge and continued until the infant was 3 years old. The program involved weekly home visits for the first year of life, with full time day care, biweekly home visits, and bimonthly parent group meetings beginning at 12 months. Subjects were centrally randomised, 93% of randomised subjects were accounted for in the analysis (by intention to treat), and outcome assessment was blinded to study group status. At 3 years' corrected age, the mean IQ difference (intervention-control) was 13.2 points for children weighing 2001-2500 g at birth, and 6.6 points for those with birth weights less than 2000 g. Further analyses of these data suggested that the effect of the intervention was related to maternal educational level. The intervention effect was greatest for the children of the least well educated mothers.

The results from randomised controlled trials are consistent with each other and with the results from observational studies. They show that out-of-home day care has a positive effect on the intellectual development of children who are at high risk for developmental delay.

#### **Infectious disease morbidity**

Because of the close contact between children in out-of-home day care, day care attendance has important implications for the transmission of infectious disease. The most common site of infection (86%) for children in day care is the respiratory tract.<sup>7</sup> Evidence from cohort studies suggests that children who attend day care centres experience a greater number of respiratory tract infections. One of the most rigorous observational studies of the effect of the type of day care on the occurrence of infections, was a cohort study conducted in the Rhône region of France.<sup>8</sup> In France, parents who use public service day care facilities have little discretion over the type of day care (family day care, small centre day care, large centre day care) that their child receives. It is claimed that parents usually accept the first position available, irrespective of the type of care. Although this is not random allocation, the quasiexperimental character of this study does confer some advantage over previous cohort studies. In addition, the risks associated with the different day care environments were adjusted for a number of the potential confounders including breast feeding, parental smoking, and family size. It was found that compared with family day care, children attending small day care centres had a higher risk of repeated infections (>6 infections, odds ratio (OR) 2.4, 95% confidence interval (CI) 1.6 to 3.7). Attendance at large day care centres was also associated with an increased risk but not as high as for small centres. The authors postulated that large centres are more likely to be based in purposely built premises for which hygienic considerations were taken into account during the planning stages. They also speculated that the children in larger centres may have been divided into similar age

groups with little contact between children of different ages.

Despite the advantages of the French study, confounding still presents a threat to the validity of the results. The validity of evidence from randomised controlled trials would be more readily assured. The Infant Health and Development Program is one such study.<sup>9</sup> This study, previously described, was a randomised trial of the effects of early intervention for preterm low birthweight infants. The outcome measures in this study included several indices of childhood morbidity. The intervention group received one year of home visiting and two years of centre based infant day care. No difference was observed between the intervention and the control group in hospital based care and the intervention group averaged two more physician visits over the three year study period than did the controls. Most of these excess physician visits occurred during the first year of day care. There are, however, two methodological issues that warrant consideration. First, at the time of entry into day care, families in the intervention group had received a year of home visits. These home visits may have influenced subsequent health care utilisation. If this is the case, then despite the randomisation, there may have been important differences between the intervention and control families at the time the infant entered day care. Second, the morbidity outcome data were based on maternal reports to assessors who were not blinded to the subject's experimental status so that there is the potential for bias. Although the standards of hygiene in the intervention day care would probably have been higher than those observed routinely, the study population (low birthweight premature infants) would represent a biologically vulnerable group. In summary, the results from this trial suggest that day care attendance is associated with a comparatively small increase in health care utilisation for minor childhood morbidity.

#### **Otitis media**

Surgery for otitis media with effusion (OME) is reported to be the most common childhood surgical intervention carried out in industrialised countries. Because of the morbidity and resource implications of OME, the effect of day care attendance on the incidence of OME has been, and remains, an important research question. The association between out-of-home day care and OME has been examined in both cohort and case-control studies.<sup>10</sup> Although to date, no quantitative overview of the available studies has been conducted, most studies report an increased risk of OME for children in out-of-home day care (OR of the order of 1.8). Once again, there are a number of methodological issues that have a bearing on validity of these results. Most important is the potential for surveillance bias. OME is often asymptomatic. If children who attend day care centres receive more intensive otological surveillance, then the risks associated with day care may have been overestimated.

Confounding presents another potential source of bias. The validity of the association between OME and day care will almost certainly depend on the extent to which the effects of other known risk factors, in particular breast feeding, socioeconomic status, and passive smoking have been controlled for. The effect of out-of-home day care on the incidence of OME has yet to be evaluated in a randomised controlled trial.

### Injury

To examine the relative safety of out-of-home day care and home care it is necessary to take into account the time children spend in the respective environments. Three cohort studies have compared the injury rates per 100 000 child hours in out-of-home day care and home care. Two studies conducted in the USA found lower injury rates during out-of-home day care. Rivara *et al* estimated an injury rate in day care of 2.50/100 000 child hours compared with 4.88/100 000 child hours in home care.<sup>11</sup> Gunn *et al* used data from a nationwide telephone survey and estimated an injury rate of 1.69/100 000 child hours for day care compared with 2.66 for home care.<sup>12</sup> However, a Swedish study found the opposite, reporting an injury rate of 1.98/100 000 child hours in day care compared with 1.54/100 000 in home care (relative risk 1.27, 95% CI 1.04 to 1.54).<sup>13</sup> The major methodological challenges in each these studies are the problem of tallying the injuries with the exposure and controlling for confounding. In the studies by Gunn *et al* and Sellstrom *et al* injury rates for out-of-home day care and home care were not directly comparable because the injury rates related to different times of the day. However, this was not a problem in the study by Rivara *et al* who did compare injury rates between out-of-home day care and home care for the same time periods. All three studies are vulnerable to bias from confounding. In particular, there may be important pre-existing developmental differences between children who attend out-of-home day care and children cared for at home that may account for the differences in injury rates. For example, many day care centres will only accept children who are toilet trained. In this way day care centres may preferentially select more developmentally mature children. In view of these methodological pitfalls it seems unlikely that the effects of day care on injury rates will be convincingly demonstrated in further observational studies. It would be more appropriate to examine this question in a randomised controlled trial.

### Crime and violence

Some of the most striking effects of the Perry preschool project have been in the domain of crime and violence. At age 19, children who attended the study preschool (97% follow up) had significantly fewer detentions and arrests (31% *v* 51%). At age 27, the experimental group had half as many arrests as the controls,

had significantly higher earnings, and were more likely to be home owners.<sup>14</sup>

### Maternal employment and equity

Since the early seventies, the number of lone parent families in Britain has increased by between 30 and 40 thousand per year.<sup>15</sup> For many lone mother families, maternal employment is the primary means of averting poverty. The effect of day care provision on maternal employment therefore has important implications for child health. Evidence that day care provision increases levels of maternal employment is provided by the Infant Health and Development Program.<sup>16</sup> Infants in the experimental group received a centre based child development programme from the second year of life. Mothers in the intervention group were employed for a greater number of months than were mothers of infants in the control group (1.84 months,  $p=0.04$ ). The effect of day care on maternal employment was greatest in the least well educated mothers (high school degree or less). Whether such effects would be observed in Britain is unclear. However, given the comparatively low proportion of British lone mothers with young children who are in paid employment, it might be expected that the effects would be the similar or greater.

### Summary

Evidence from randomised trials indicates that out-of-home day care has important effects in domains that are integral to the health of mothers and children. The evidence that day care results in cognitive gains is compelling. These effects and the long term effects in reducing crime and violence should suffice to put the question of day care provision high on the paediatric agenda. However, some important questions remain to be answered. Evidence from a randomised trial suggests that the effect of infant day care on infectious disease morbidity is not as great as would be expected on the basis of results from observational studies. However, the trial in question had some important methodological weaknesses. No trials to date have examined the effect of day care on otitis media. Data from observational studies on the effect of day care on injury occurrence are conflicting. Finally, studies in the US point to an important effect of out-of-home day care on maternal employment. The effect of day care on maternal employment and income inequality in Britain has yet to be examined.

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