



THE HEALTH AND WELFARE EFFECTS OF DAY-CARE: A SYSTEMATIC REVIEW OF RANDOMISED CONTROLLED TRIALS

B. ZORITCH,^{1*} I. ROBERTS² and A. OAKLEY³

¹Childrens Unit, St. Peter's Hospital, Guilford Road, Chertsey, Surrey KT16 0PZ, U.K., ²Institute of Child Health, 30 Guilford Street, London WC1N 1EH, U.K. and ³Social Science Research Unit, University of London Institute of Education, 18 Woburn Square, London WC1H 0NS, U.K.

Abstract—Day-care has long been a controversial aspect of social policy in countries such as the U.K. What evidence is there about the effects of out-of-home day-care on educational, health and welfare outcomes for children and their families? This paper applies to day-care studies, the methodology of the systematic review as pioneered in the health care field, in order to establish the evidence-base for day-care provision. Randomised controlled trials of day-care for pre-school children were identified using electronic databases, hand searches of relevant literature and contacts with authors. A total of 8 trials were identified after examining 920 abstracts and 19 books. All the trials were carried out in the U.S.A. European research on this topic is extensive but we did not identify any studies using trial design. Instead observational, case controlled and cohort studies were prominent. The trials were assessed for methodological quality. Results showed that day-care promotes children's intelligence, development and school achievement. Long-term follow up demonstrates increased employment, lower teenage pregnancy rates, higher socio-economic status and decreased criminal behaviour. There are positive effects on mothers' education, employment and interaction with children. Effects on fathers have not been examined. Few studies look at a range of outcomes spanning the health, education and welfare domains. Most of the trials combined non-parental day-care with some element of parent training or education (mostly targeted at mothers); they did not disentangle the possible effects of these two interventions. The trials had other significant methodological weaknesses, pointing to the importance of improving on study design in this field. There is a need for well designed research on day-care to provide an evidence-base for British social policy. © 1998 Elsevier Science Ltd. All rights reserved

Key words—day-care, social policy, systematic review, children, families

INTRODUCTION

The debate about how, where and by whom young children should be looked after is one which has occupied much social policy and media attention in recent years. Mothers undertake most of the care of young children. Internationally, out-of-home day-care provision ranges widely, from 2% of under three's in Britain to 48% in Denmark (Meltzer, 1994). These different levels of provision are not simply a response to different levels of demand for day-care, but reflect cultural and economic interests concerning the welfare of children, the need to promote mothers' participation in paid work and the importance of socialising children into society's values (Kamerman, 1993). In Europe and North America there is greater consensus about the value of day-care for children over three than there is for children under 3 years. As regards the latter group, ideas about the necessity of psychological attachment to, and care by, mothers continue to hold considerable sway in some social contexts (Bowlby,

1951; Ainsworth and Wittig, 1969; Belsky and Rovine, 1988; Sroufe *et al.*, 1990).

At a time when a decline in family values is held responsible for a range of social problems, the day-care debate has a special prominence. A second significant strand here is the argument that contemporary strains on families rebound on both the quantity and quality of parenting; more children are raised by lone parents and more parenting fails to meet children's needs. An important policy response has been the rise of parenting programmes, which offer a variety of packages of support, education, counselling and training (Pugh *et al.*, 1994). These are mainly targeted at families considered to be "at risk" and mothers are the main recipients of attention. On the basis of a rhetoric of effectiveness, some of these programmes are attracting significant amounts of statutory and voluntary funding in the U.K., but none have been systematically evaluated (Oakley *et al.*, forthcoming).

In the health care field, debates about effective and appropriate interventions are increasingly settled by referring to the evidence-base of randomised controlled trials, the "gold standard" evaluation method (Chalmers and Altman, 1995). The

*Author for correspondence.

approach is controversial in the field of social interventions (Oakley and Roberts, 1996a,b). There is a substantial body of evidence indicating that, as with health care, less rigorous evaluation methods tend to yield biased estimates of intervention effects (Logan, 1972; Campbell and Boruch, 1975; Gough, 1993; Schulz *et al.*, 1995; Oakley and Fullerton, 1996). As a consequence, interventions may be viewed as beneficial when they are harmful or ineffective, as harmful when they are beneficial or ineffective, or as ineffective when they are either beneficial or harmful.

To avoid these pitfalls, a systematic review was conducted to assess the effects of day-care on children and families. The review aimed to assess the standard of evaluation in this field, to arrive at the best estimate of the effects of day-care, to consider the implications of this for social policy in Britain and to make recommendations for future research in this field.

METHODS

The review followed the procedures outlined for systematic reviews of health care (Chalmers and Altman, 1995) and those applied to health promotion and other social interventions (Oakley *et al.*, 1995a,b). Studies were included if they met the following criteria: (1) the intervention involved the provision of non-parental day-care for children under five; (2) the evaluation design was that of a randomised or quasi-randomised (e.g. alternation) controlled trial. There were no language restrictions.

Seven electronic databases were searched: Medline, Embase, the Cochrane Controlled Trial Register, the Social Science Citation Index, PsycLit, Eric and BIRD (French language database). For the Medline and Embase searches, the Cochrane optimally sensitive search strategy for randomised controlled trials (Dickersin *et al.*, 1994) was used in conjunction with the terms "child day-care centres", "school-nurseries", "infant-premature", "infant-low birth weight", "education", "child development", "early intervention" and "family day-care". The Cochrane Controlled Trial Register was searched using the terms "day-care", "nursery school" and "child development". For the searches of the social science databases, key terms were constructed using published indexes from these databases. Two journals were searched by hand from 1977 to 1996: *Child Development* and *The Journal of Child Abuse and Neglect*. A core of relevant references was obtained from an earlier non-systematic review of day-care (Roberts, 1996). The references to all relevant papers identified were searched, as were bibliographies of books, trial reports, review articles (Ramey *et al.*, 1982, 1985; Zigler and Weiss, 1985; Farran, 1990; Seitz, 1990; Benasich *et al.*, 1992) and conference proceedings. The authors of all eligible

studies were contacted, as were two British authors well-known in this area of research; they were asked to identify any trials not listed in the bibliography produced by the electronic and hand-searches. Authors of eligible studies were also asked to provide further information on study methodology, outcomes not already reported, and any long-term follow up data that might have become available.

Identified trials were assessed for methodological quality using the criteria developed by Prendeville *et al.* (1988). This method provides an assessment of the extent to which bias may have affected the study results. Trials are scored on three dimensions: (1) whether those enrolling the study participants could know which treatment was next in line (knowing can result in experimental and control groups that are not equivalent on socio-demographic and other characteristics; (2) whether the primary analysis was based on all cases randomly allocated (where this is not the case and significant attrition has occurred conclusions based on a subsample may be biased) and (3) whether assessment of the outcome may have been affected by knowledge of treatment allocation. On each criterion, a maximum score of 3 indicates methodological strength. The following outcomes were defined in advance and searched for in all studies: changes in developmental and/or intelligence quotients, school performance and attitude, children's behaviour, children's health, maternal employment, fertility and interaction with children. Other reported outcomes were also included.

Because of the heterogeneity of the interventions and the outcomes measured, a mathematical synthesis of intervention effects would be inappropriate. Instead, we discuss the results from the studies in narrative form in Section 3.

RESULTS

The Medline search yielded 453 abstracts, of which 19 were included in the review. The figures for Embase were 211 and 2. The Cochrane database provided 50 references, only one of which had not already been identified. No new studies were found using the social science databases (a large number of observational studies had to be searched through, because the key terms do not allow trials to be separated out). Neither hand-searching nor author-contacts yielded any new studies, although two authors gave useful follow up and new outcome data. Searching the bibliographies of books and references generated a further 20 abstracts which provided information for the review. Altogether 920 abstracts or papers and 19 books were examined. A total of 8 trials of non-parental day-care were found. Many of these had resulted in multiple publications.

The methodological status of studies

Seven of the eight trials were randomised controlled trials. The Milwaukee study was a quasi-randomised prospective controlled trial. A month was randomised as treatment or control month and several children born that month were allocated to groups accordingly. There was a deviation from randomisation procedure in the Perry Pre-School Program, as 5 children changed group status from intervention to control because of maternal employment.

Table 1 shows the number of randomised participants, age of the children, length of follow-up and the methodological scoring for the 10 studies. All of the studies were conducted in the U.S.A. In total 2203 children were randomised to receive day-care or be in a control group. Three studies had over 300 participants, three had under 100. None of the children were older than four at the start of the intervention; in 4 studies, the intervention started when children were under one and in one of these, at birth. Length of follow up ranged from 6 months to 27 years. The longest follow-up was for the Perry Pre-School Project; the Carolina Abecedarian Project had a 15 year follow-up. In the Milwaukee Project the 7 year follow-up data were supplemented by 11 year follow up data for certain educational outcomes.

While all 8 studies stated that random allocation was used to allocate participants to intervention and control groups, only 3 studies described the randomisation process. Only one study used what has been shown to be the most valid method of allocation concealment, namely, central randomisation using a computer-generated sequence. The authors of 7 studies were asked to give more details about the randomisation process; two replied. There were no studies where the primary analysis of the principal outcome was based on all participants

as randomised. Attrition ranged from 3 to 81% and in one study (Deutsch and Taleporos, 1974, Institute for Developmental Studies), it was unbalanced between experimental and control groups. Four studies took steps to ensure that the outcome assessment was made blind to whether or not the participants were in the experimental or control groups. Three studies did not have blind outcome assessment although in two of these longer term follow up was done by researchers from Consortium for Longitudinal Studies who had better blinding of the observers than the original researchers. Nevertheless, even they could have some possibility of bias, particularly at the interview stage.

Other characteristics of studies

Table 2 shows, for each programme, the study population, whether the intervention was centre- or home-based, the nature and intensity of the intervention and the outcomes assessed. Most of the studies targeted families of lower socio-economic status; only two also included middle-class families. All except one study targeted children of African-American origin only. Boys and girls were included except for one study which only targeted boys. Significantly, nearly all the studies mixed an element of out-of-home day-care with some home visiting and targeted parental training. Only three studies did not include an element of home visits. Some studies had a specific intervention group of home visits which was evaluated as a comparison group; others tried to involve families as part of a centre-based day-care intervention. Some studies offered a different intervention to control group families: play activity, social work services and/or formula milk, health services, or payment to parents.

The studies varied greatly in the intensity of intervention. Duration of day-care ranged from 2 h a week for 8 months to 7 h per day, 5 days per

Table 1. Methodological appraisal and length of follow up

Trial	Allocation concealment	Analysed as randomised ^a	Blinding ^a	Number of participants randomised	Length of follow up (years) ^b	Age at entry into study
Parent Training project (Gray and Klaus, 1970)	1	2	1	65	12	3 years
Minimal Intervention (Palmer and Siegel, 1977)	1	2	1	310	9	2 years
Perry Preschool Project (Schweinhart <i>et al.</i> , 1993)	2	2	3	128	24	3 years
Institute for Developmental Studies (Deutsch, 1966; Deutsch and Taleporos, 1974)	1	1	2	504	13	4 years
Milwaukee Project (Garber, 1988)	1	2	1	40	7	3 months
Carolina Abecedarian Project (Campbell and Ramey, 1994)	1	2	3	111	12-15	6 weeks
Project CARE (Wasik <i>et al.</i> , 1990)	1	2	2	65	0.5	6 weeks
Infant Health and Development Program (Brooks-Gunn <i>et al.</i> , 1994a,b)	3	2	3	985	2	birth

^aThese criteria are outcome dependent. IQ/developmental quotient and school achievement are the main outcomes with which these two criteria are assessed. The other outcomes were less likely to have as detailed a description in terms of methodology.

^bLength of follow up after the end of intervention period.

Table 2. Study population, type and intensity of intervention and outcomes measured

Trial	Study population	Intervention	Intensity	Outcome
Early training project	mother's education < 8 years, 1/3 single parents	E = 2–3 years summer school and home visits in winter C = 2 × week play in the last summer	summer: 4 h daily for 10 weeks; winter: 1 h weekly for 9 months	IQ, measures of achievement and language
Consortium follow up				school competence, developed abilities, children's attitude and impact on family
Minimal Intervention	boys and their mothers, different income levels	one to one intervention in a centre	2 h a week for 8 months	IQ levels, language, various measures of performance related to development
Consortium follow up				school competence, developed abilities, children's attitude and impact on family
Perry Pre-school Program	53% 2-parent families; mother's education = 9.7 years, 70% had at least one parent employed	centre based + home visits, 1 teacher per 6 children	30 weeks a year 12.5 h a week in the centre, 1.5 h a week at home with mothers for 2 years (18% for one year)	IQ change, special educational placement, grade retention, social development, parental satisfaction with children's school performance, educational aspirations and expectations, delinquent behaviour, employment, self confidence, relationship with parents
Institute for Developmental Studies	low socio-economic status families	centre based program, with small groups of children, with strong parent/community based program	language development concept formation perceptual and overall cognitive development and self concept	school competence, developed abilities, children's attitude and impact on family
Milwaukee Project	infants from families with lower socio-economic status, maternal IQ < 75	infant/early childhood stimulation and family/maternal rehabilitation; home visits initially, one to one stimulation with the infant up to 10/12, small group centre-based training program afterwards	home = 4 months; center = 6 years for child 5 days per week 7 h per day; 2 years for mother	developmental quotient, IQ, school achievement
Carolina Abecedarian Project	families with low socio-economic status, average IQ of mothers = 87; 25% two-parent families	E = day care, social work services and infant formula; home-school resource teacher when children entered school; C = social work services and infant formula	8 h a day of day care, 50 weeks per year in the centre for 5 years, children in school between 5–8 years of age formed separate intervention group	IQ scores, school achievement, mother-child interaction, maternal employment and education, children's psychological well-being
Project CARE	low socio-economic status, average IQ for mothers = 87; 25% two-parent families	E1 = day care + home visits; teacher ratio 1:3 for infants, 1:4 for 2 year olds and 1:6 for 3–5 year olds; E2 = home visits and infant formula; C = infant formula	6–8 h a day all year round, for 52 months; home visits 2–3 visits per month in the first 3 years and 1–2 visits in the last 2 years	developmental index and IQ, home environment, child rearing attitudes,
Infant Health and Development Program	babies born prematurely with different socio-economic background and ethnic groups	home visits in the first year biweekly and weekly afterwards, day care between 1–3 years of age, parental support	day care minimum 4 h a day 5 days per week for 3 years, non-compliance 14%; analysed as intention to treat	developmental quotient and IQ, behavioural competence, health status, health care use, weight gain, maternal employment, public assistance and health insurance, mother-child interaction

week for 5 years. Some studies had specific curricula for their programmes; others did not. All the projects were explicitly concerned with the attainment of basic cognitive concepts and many of the programmes emphasised linguistic development. The ratio of teachers to children was not less than 1:6 for older children and 1:1 for infants.

As regards outcomes for the children, all the studies looked at cognitive development, 6 at school

performance and attitude, 4 at behaviour and 1 at health outcomes. Four studies collected and reported data on maternal employment and two on subsequent childbearing. Five studies also included data on mother-child interaction.

Developmental and educational effects of day-care

Several different methods of assessing intelligence and development were used, partly because of the

Table 3. Summary of IQ results or developmental index from 12 trials. Results at various ages unless indicated; 4 months–10 years: Stanford-Binet; 13–17 years: Wechsler Intelligence Scale for Children

Project	4–7 m	10–13 m	18–19 m	22–25 m	27–33 m	35–37 m	38–43 m	4 y	5 y	6 y	7 y	8 y	9 y	10 y	Later FU
Early Training Project								E89 ^a C86	96 87	95 83	98 91	94 88		88 85	79 76 (17 y)
Minimal Intervention				E94 C85				98 93	96 91						92 89 (12 y)
Perry Preschool Program						E79 C78		96 83	95 84	91 86	92 87	88 87	88 87	85 84	81 81 (age 14)
Institute for Developmental Studies								E93 C90	101 88						
Milwaukee Project		E117 ^b C113	118 101	125 ^a 96	124 94	126 94	125 95	126 96	118 93	119 87	103 ^c 81	103 83	103 84	104 86	101 91 (14 y)
Carolina Abecedarian Project	E107 C101	111 105	107 90	96 85	102 ^d 93	101 84		102 89	101 94						95 90 (15 y)
Project CARE	E1 109 E2 107 C105	119 108 108	119 94 103	114 89 97	108 ^d 90 100	105 89 93		93 87 91							
Infant Health and Development Program	E107 C107			103 93		94 85 *LBW H14 L7			92 91 *LBW -H4 -L no effect						

^aStanford-Binet.^bGessel.^cWechsler scales.^dMcCarthy scales of development.

E: experimental group; E1: day care; E2: home visits.

C: control group.

*LBW low birth weight. Babies were divided in 2 groups: (H) heavier and (L) lighter LBW groups.

H: difference in IQ between controls and heavier low birth weight infants; L: difference in IQ between controls and lighter low birth weight infants.

different age groups. All the studies showed that IQ was increased by participation in day-care, although there was no pre-test measure for minimal intervention study. Significantly, although home visits were provided to one group of children in project CARE, to enhance their cognitive gains, this was not associated with increased IQ. Results from multiple regression analysis showed that the involvement of fathers in the Infant Health and Development Program was associated with better cognitive outcome (Yogman *et al.*, 1995). The "IQ effect" appeared to wash out a year or two after the end of intervention in most studies, but the early cognitive gain was associated with later prevention of school failure. The Perry Pre-School Programme, showed an IQ difference of 13 points following a year of intervention; there was a difference of 5 points 2 years after the end of the intervention at age 7; at 14 there was no IQ difference (Table 3), but many experimental-control group differences in the area of school achievement favoured the experimental group.

Measures of school achievement used included placement in special education classes, being kept down in the same class for a second year, children's own evaluation of their school performance and a range of tests of competence in reading, writing, mathematics and general knowledge. This information was available for 7 studies. All except one of the studies which included these measures showed a persistent difference favouring the experimental group. In the Early Training Project 29% of control children had special education classes compared to 3% in the intervention group. The difference is still significant for the Perry Pre-school Project, even though it was the lowest of the 8 studies (50% control children were placed in special educational classes vs 37% in the intervention group). The difference in Infant Health and Development Program was not significant at 3% for the whole group, although when only heavier infants were compared, the difference was 7%, favouring experimental group. This outcome only recently became available as the children are now age 8 years. The heavier infants also showed better reading the writing scores, but scores of the whole groups and lighter LBW infants were no different between intervention and control. Children in 6 out of 7 studies were more likely to be retained in grade if in control group. The differences varied from 15–23% between the groups in all studies except for Infant Health and Development Program where it was only 1% when children were 8 years of age. Milwaukee Project, the only exception, had experimental and control groups which differed pre-intervention, a less valid randomisation process, and a small study size. However, early results for Milwaukee when children were 8 years of age, were also favouring the experimental group, although this did not persist at the age of 12 years. Both

retention in grade and special education classes appear to have a more meaningful outcome when the children are older and reporting it at age 8 years may be too early to see stable differences between groups.

Behavioural and health effects of day-care

Three studies looked at the effect of day-care on children's behaviour. In the Perry Pre-School Project, pre-school education led to improved classroom and personal behaviour at 6–9 years as rated by teachers. At ages 6–9, teachers judged the programme children as more motivated and they themselves placed greater value on schooling when they were 15 years old (Berrueta-Clement *et al.*, 1984). "Chronic delinquent" behaviour was self-reported in 36% of experimental and 52% of control group children; 43% of the experimental group were non-offenders or had offended only once, compared with 25% in the control group. Long-term follow up at the age of 27 years showed that 5 times as many control group members had been arrested 5 or more times (7% vs 35%) and three times as many had been arrested for drug dealing (7% vs 25%). This data was independently verified using prison records (Schweinhart *et al.*, 1993).

In the Milwaukee study the intervention children were more likely to show disruptive behaviour than controls. In the Abecedarian study, programme children were slightly more likely to be retained in special education classes for behavioural problems; follow up at 8 years showed no experimental-control group differences on various psychological scales; these began to emerge at 12 and 15 years, when experimental group children rated themselves higher on self-concept than control children (Campbell and Ramey, 1994, 1995; Campbell, 1995, 1996). In the Infant Health and Development Program, maternal ratings of child behaviour showed higher scores for intervention children at 3 but not at 5 years (Spiker *et al.*, 1993). Researchers blind to subjects' status who rated videotapes of mother-child interaction at 30 months scored the intervention group higher on measures of persistence, positive involvement with task and enthusiasm. There was no difference in behaviour problems between the 2 groups at age 8 years (McCarton, 1997). However, mothers in the group of lighter LBW infants perceived their children as having more role/social limitation due to behaviour, if they were in intervention group. This was mainly in the area of concentration and attention. The other measures, including self esteem, mental health, emotional health and physical functioning did not show any difference.

The one study which included child health outcomes was the Infant Health and Development Program. The average number of reported health conditions was higher for the intervention group at age 3 years (an excess of 0.27 conditions per year),

but not at 5 years; hospitalisation rates were similar (McCormick *et al.*, 1991).

Effects of day-care on mothers

In the Abecedarian Project, programme and control group mothers were comparable on education and employment pre-intervention, but programme mothers had on average one more year of education than controls when their children were 54 months old, fewer were unemployed or had unskilled jobs and more were financially self-supporting (Campbell *et al.*, 1986). Mothers in the Milwaukee Project were more likely to have a stable employment history and a higher weekly income if their children were in the experimental group. The Perry Pre-school programme reported no significant difference in maternal employment as a function of intervention status. Mothers in the experimental group in the Infant Health and Development Programme had more employment than control mothers and entered the work force when their children were younger. In the one study that looked at subsequent childbearing, Project Care, teenage programme mothers were less likely to have further children (23% vs 40%).

Four studies included mother-child interaction as an outcome. In the Abecedarian Project, videotaped sessions suggested that experimental infants communicated with their mothers at a higher level, they were 4 times more likely to try to modify their mothers' behaviour and had longer periods of mutual play (Ramey *et al.*, 1982). Researchers in the Milwaukee project found increased mother-child reciprocal communication, as did those in the Infant Health and Development Program (Spiker *et al.*, 1993). In the Perry Pre-school Program, there were no differences on measures of "closeness" and quality of relationships derived from interviewing parents and children at 15 years (Berrueta-Clement *et al.*, 1984).

Long term effects of day-care

Only the Perry Pre-School project collected data on long-term follow up. These data cover 123 (96%) of the 128 children originally recruited. The follow up results show that more of the experimental group held jobs at age 19 (50% vs 32%), and more were attending college or job-training programmes (38% vs 21%); fewer of the experimental group were in receipt of welfare assistance (18% vs 32%), had experienced teenage pregnancy (64 per 100 young women in the experimental group vs 117 per 100 for controls), or had been arrested for criminal acts (31% vs 51%). This difference was maintained at 27 years, when experimental group members had a higher rate of high school graduation (71% vs 54%), half as many arrests (2.3 vs 4.6), significantly higher earnings (\$1219 vs \$766 a month), were less likely to depend on welfare assistance (15% vs 32%) and more likely to be home-

owners (36% vs 13%). Marriage rates were also higher, and single parent rates lower, for experimental group members.

CONCLUSION

The methodological state of the field

Good evaluation design implies the use of both qualitative and quantitative methods and randomised controlled trials are not an appropriate research design for all questions. However when it comes to questions of effectiveness, a socially comparable control group is essential for validity. Neither evidence-based social or health policy is best advanced by listening to claims about effectiveness based on less robust designs.

The review reported in this paper confirms others carried out in the field of social interventions, where finding methodologically sound studies has been described as akin to the metaphorical search for a needle in a haystack (Oakley and Fullerton, 1996). The filter of a systematic review reduces a large universe of studies to a small number of trials conducted with sufficient methodological rigour to make their results credible. The major methodological failings identified in this review were (1) not evaluating the intervention of day-care at all; (2) using an observational or other non-experimental study design and (3) (in the experimental studies) not taking steps to ensure that experimental and control groups are similar, a task which is best achieved by good randomisation with adequate allocation concealment. In their methodological study of treatment effects in controlled trials, Schulz *et al.* (1995) showed that adequate allocation concealment is the most important criterion in ensuring the methodological quality of studies.

By including all eligible trials, systematic reviews aim to avoid biased ascertainment. However, bias may arise if relevant published or unpublished studies are missed. Although our search strategy was designed to minimise the number of missed studies, the possibility of biased ascertainment is open to question.

Estimating the effects of day-care

Evidence from randomised trials indicates that out-of-home day-care has beneficial effects in important areas of children's well-being, particularly in enhancing cognitive development and preventing later school failure, which were the outcomes most commonly measured. It also appears that longer interventions are linked with more academic success, but it is unclear what the precise timing should be. The Perry Pre-school Project suggests that the chance of success is higher if the intervention starts at 3 rather than 4 years; the Abecedarian Project started at 6 months and continued until 5 years and had the best outcome. The Minimal Intervention

project was the least intensive approach; it started at 2 years but has still shown a difference at the age of 16 years.

The studies included in the review also show that pre-school education has a beneficial effect on children's behaviour. This conclusion is significantly different from that derived from observational studies, which is that children in day-care show disturbed and difficult behaviour (McGuire and Richman, 1986) or negative moods and aggressive behaviour (Melhuish and Moss, 1990). This difference highlights the importance of distinguishing well-designed studies. The studies discussed in this paper also suggest a link between early behavioural differences and later behaviour. The long-term evidence from the Perry Pre-school Project showing reduced rates of criminal behaviour in experimental children is particularly compelling.

None of the trials looked at a range of educational, health and welfare outcomes for children. There is some evidence that children in day-care do have more minor illness than those cared for exclusively at home. Most researchers who have looked at maternal outcomes in terms of employment and education have found that centre-based day-care increases maternal employment and education, which in turn improves the socio-economic status of families and is likely to mediate outcome for the children in terms of cognitive development and school success.

The results of the review in terms of mother-child interaction should be reassuring to those who may be concerned about the potentially damaging effects of day-care on attachment. There is evidence that children in day-care communicate better with their mothers than those not in day-care. This counters the argument of Belsky and Rovine (1988) amongst others, that day-care starting below one year is likely to be associated with unsecure-avoidant attachment of child to mother. Recent unpublished evidence in a large cohort study indicates that it is the quality of the mother-child relationship rather than placement in day-care that determines secure attachment (National Institute of Child Health and Human Development, 1996).

Four trials were not included in this review: three trials of Parent-Child Development Centers (Andrews *et al.*, 1982; Johnson and Walker, 1987, 1991) and a trial of a Parent Training Program (Field *et al.*, 1982; Stone *et al.*, 1988). We omitted these because they all required mothers to attend with their children during the provision of day-care. It is, of course, a significant research question as to whether the effects of day-care are different according to whether or not mothers (or indeed fathers) are present. Interestingly, the results of these 4 studies suggest relatively small or no effects of such an approach involving mothers.

Social policy implications

The evidence suggests that day-care has a positive effect on a number of important social outcomes for children and families. However, impeding translation of this message into social policy is the dominant ideological perspective in countries such as Britain which see child care as the responsibility of mothers, and as belonging to the private domain. Other countries take a different view (Sommer, 1992). For example, research effort in Nordic countries is devoted to answering questions about the optimal period of day-care attendance and further development in the quality of day-care. Its effectiveness and policy-desirability are broadly accepted.

Structural changes in the family and employment sectors mean that more and more children are being brought up in lone parent families, and an increasing proportion of mothers of young children are in the paid labour force (Ditch *et al.*, 1994; Haskey, 1996). In Britain and the U.S.A. mothers and children living on their own are emerging as the social group most likely to live in poverty (Judge and Benzeval, 1993). Current debates about the increasing burden of welfare spending, declining family values and rising rates of school failure and juvenile crime, highlight the importance of early intervention to avoid a range of adverse outcomes for both children and families (Yoshikawa, 1994; Shepherd and Farrington, 1995). Provision of out-of-home day-care is one such intervention. It is a routine part of educational provision in some countries. It is popular with mothers and demand frequently exceeds supply: a 1990 survey carried out for the British Department of Health found that over 40% of mothers of 3 and 4 year olds not attending day nursery would like them to do so (Meltzer, 1994). The data drawn on in this review show the potential of day-care to increase maternal education and employment. Other analyses have shown that day-care may be significantly cost-effective in terms of increased maternal earnings (Joshi and Davies, 1992).

Research implications

All the studies included in this review were carried out in the U.S.A. Most of them were targeted attempts to improve outcomes in socially disadvantaged populations, rather than efforts to evaluate the policy of providing day-care for children from different social backgrounds. No trials of day-care have been conducted in Britain, where the discussion of day-care effects is dominated by an appeal to weak observational data. A pilot study for a trial of day-care is currently in progress, exploring parents' understanding of the need for this type of research and their willingness to take part in a trial (Oakley and Roberts, 1996a,b). Well-designed research addressing questions of effectiveness is

required. Such research needs to get away from the fragmentation of research questions and children's and adult's lives into the different domains of education, health and welfare. At the level of bodies and individual experience, interventions can rarely be dis-aggregated.

As suggest above, there is also a need to separate out the effects of parent-training, parent-education or parent-support interventions from those attributable to day-care. The same provisos apply to the evaluation of parent-involvement interventions as to day-care. Many claims about the effectiveness of parent-involvement interventions are based on observational data only (Home-Start, 1993; Newpin, 1993) and may therefore offer biased estimates of their effects.

It is important that any trial of pre-school day-care in Britain should avoid the weaknesses of previous work identified in this review. Particular attention needs to be paid to generating comparable intervention and control groups, using valid procedures for allocation concealment. Steps also need to be taken to ensure minimal loss to follow up, adequate length of follow up to examine long-term educational and social outcomes and blinding of outcome assessment. Most importantly, future work needs to integrate information on both processes and outcomes and collect both qualitative and quantitative data across a range of education, health and welfare outcomes (Oakley, 1992). Parents' perception of different kinds of day-care and how appropriate they are for families needs as well as children's own experience should be included in future research. Although long term effects on education and welfare are important, the short term psychological effects, particularly emotional and behavioural consequences of day-care on children should be studied in trial design.

UNLINKED REFERENCES

Blair *et al.*, 1995; Brooks-Gunn *et al.*, 1992a; Brooks-Gunn and Hearn, 1982; Brooks-Gunn *et al.*, 1993, 1992b; Burchinal *et al.*, 1989; Casey *et al.*, 1994; Department of Health, 1991; Gray *et al.*, 1981; Haskey, 1994; Kirby *et al.*, 1993; Kraemer and Fendt, 1990; Lazar *et al.*, 1982; Martin *et al.*, 1990; McCormick *et al.*, 1993; Ramey and Smith, 1976; Ramey and Haskins, 1981; Ramey *et al.*, 1984a; Ramey and Campbell, 1984b; Ramey *et al.*, 1992; Roberts *et al.*, 1989; IHDP, 1990

REFERENCES

- Ainsworth, M. D. S. and Wittig, B. A. (1969) Attachment and exploratory behaviour of one-year-olds in a strange situation. In *Determinants of Infant Behaviour*, ed. B. M. Foss. Methuen, London.
- Andrews, S. R., Blumenthal, J. B., Johnson, D. L., Kahn, A. L., Ferguson, C. J., Lasater, T. M., Malone, P. E. and Wallace, D. B. (1982) The skills of mothering: a study of parent child development centers. *Monographs of the Society for Research in Child Development* 47 (Serial No. 198, No. 6).
- Belsky, J. and Rovine, M. (1988) Non-maternal care in the first year of life and security of infant-parent attachment. *Child Development* 59, 157-167.
- Benasich, A. A., Brooks-Gunn, J. and Clewell, B. C. (1992) How do mothers benefit from early intervention programs. *Journal of Applied Developmental Psychology* 13, 311-362.
- Berrueta-Clement, J. R., Schweinhart, L. J., Barnett, W. S., Epstein, A. S. and Weikart, D. P. (1984) *Changed Lives: The Effects of the Perry Pre-school Program on Youths through Age 19*. High Scope Press, Ypsilanti.
- Blair, C., Ramey, C. T. and Hardin, J. M. (1995) Early intervention for low birthweight, premature infants: participation and intellectual development. *American Journal of Mental Retardation* 99(5), 542-554.
- Bowlby, J. (1951) *Maternal Care and Mental Health*. World Health Organisation, Geneva.
- Brooks-Gunn, J., Gross, R. T., Kraemer, H. C., Spiker, D. and Shapiro, S. (1992a) Enhancing the cognitive outcomes of low birth weight, premature infants: for whom is the intervention most effective? *Pediatrics* Jun. 89(6 (Part 2)), 1209-1215.
- Brooks-Gunn, J. and Hearn, R. P. (1982) *Early Intervention and Developmental Dysfunction: Implication for Paediatrics. Advances in Paediatrics*. Year Book Medical Publishers, pp. 497-527.
- Brooks-Gunn, J., Klebanov, P. K., Liaw, F. and Spiker, D. (1993) Enhancing the development of low-birth-weight, premature infants: changes in cognition and behavior over the first three years. *Child Development* 64(3), 736-753.
- Brooks-Gunn, J., Liaw, F. R. and Klebanov, P. K. (1992b) Effects of early intervention on cognitive function of low birth weight preterm infants. *Journal of Pediatrics* 120(3), 350-359.
- Brooks-Gunn, J., McCarton, C. M., Casey, P. H., McCormick, M. C., Bauer, C. R., Bernbaum, J. C., Tyson, J., Swanson, M., Bennett, F. C. and Scott, D. T. *et al.* (1994a) Early intervention in low-birth-weight premature infants. Results through age 5 years from the Infant Health and Development Program. *JAMA* 272(16), 1257-1262.
- Brooks-Gunn, J., McCormick, M. C., Shapiro, S., Benasich, A. and Black, G. W. (1994b) The effects of early education intervention on maternal employment, public assistance and health insurance: the infant health and development program. *American Journal of Public Health* 84(6), 924-931.
- Burchinal, M., Lee, M. and Ramey, C. (1989) Type of day care and pre-school intellectual development in disadvantaged children. *Child Development* 60, 128-137.
- Campbell, F. A., Breitmayer, B. and Ramey, C. T. (1986) Disadvantaged single teenage mothers and their children: consequences of free educational day care. *Family Relations* 35, 63-68.
- Campbell, F. A. and Ramey, C. T. (1994) Effects of early intervention on intellectual and academic achievement: a follow-up study of children from low-income families. *Child Development* 65, 684-698.
- Campbell, D. T. and Boruch, R. F. (1975) Making the case for randomized assignments to treatments by considering the alternatives: six ways in which quasi-experimental evaluations in compensatory education tend to underestimate effects. In *Evaluation and Experiments: Some Critical Issues in Assessing Social Programs*, eds. C. A. Bennett and A. A. Lumsdaine. Academic Press, New York.
- Campbell, F. A. (1995) *The Development of Academic Self-concept and its Relationship to Academic Performance and Self-esteem: A Longitudinal Study of*

- African American Students*. Society for Research in Child Development, Indianapolis.
- Campbell, F. A. (1996) *The Effects of Intensive Early Childhood Educational Intervention on Assignments to Special Education in School: The Abecedarian Study*. Society for Research in Adolescence, Boston, MA.
- Campbell, F. A. and Ramey, C. T. (1995) Cognitive and school outcomes for high risk African-American students at middle adolescence: positive effects of early intervention. *American Educational Research Journal* **32**(4), 743–772.
- Casey, P. H., Kelleher, K. J., Bradley, R. H., Kellogg, K. W., Kirby, R. S. and Whiteside, L. (1994) A multifaceted intervention for infants with failure to thrive. A prospective study. *Archives of Pediatric and Adolescent Medicine* **148**(10), 1071–1077.
- Chalmers, I., Altman, D. G. (1995) *Systematic Reviews*. BMJ Publishing Group, London.
- Department of Health (1991) *Children's Day-care Facilities at 31 March 1990 in England*. HMSO, London.
- Deutsch, M. (1966) Facilitating development in pre-school child: social and psychological perspectives. In *Pre-school Education Today*, ed. F. M. Hechinger, pp. 73–97. Doubleday and Company, Garden City, New York.
- Deutsch, M. and Taleporos, E. (1974) A brief synopsis of an initial enrichment program in early childhood. In *A Report on Longitudinal Evaluations of Preschool Programs*, ed. S. Ryan, Vol. 1 (DHEW Publication No. [OHD] 74-24). Office of Child Development, Washington D.C.
- Dickersin, K., Scherer, R. and Lefebvre, C. (1994) Identifying relevant studies for systematic reviews. *British Medical Journal* **309**, 1286–1291.
- Ditch, J., Barnes, H., Bradshaw, J., Commaille, J. and Eardley, T. (1994) *European Observatory on National Family Policies: Developments in National Family Policies in 1994*. Social Policy Research Unit, University of York, York.
- Farran, D. C. (1990) Effects of intervention with disadvantaged and disabled children: A decade review. In *Handbook of Early Childhood Intervention*, eds. S. Meisels and J. P. Shonkoff. Cambridge University Press.
- Field, T., Widmayer, S., Greenberg, R. and Stoller, S. (1982) Effects of parent training on teenage mother and their infants. *Pediatrics* **69**(6), 703–707.
- Garber, H. L. (1988) *The Milwaukee Project: Preventing Mental Retardation in Children at Risk*. Published by American Association on Mental Retardation.
- Gough, D. (1993) *Child Abuse Interventions: A Review of the Research Literature*. HMSO, London.
- Gray, S. W. and Klaus, R. A. (1970) The early training project: a seventh year report. *Child Development* **41**, 909–924.
- Gray, S. W., Ramsey, B. K. and Klaus, R. A. (1981) *From Three to Twenty, the Early Training Project in Longitudinal Perspective*. University Park, Baltimore.
- Haskey, J. (1994) Estimated numbers of one-parent families and their prevalence in Great Britain in 1991. *Population Trends* **78**, 5–19.
- Haskey, J. (1996) Population review: (6) Families and households in Great Britain. *Population trends* **85**, 7–24.
- Home-Start (1993) *Publicity Brochure*. Home-Start, Leicester, U.K.
- Johnson, D. L. and Walker, T. (1987) Primary prevention of behaviour problems in Mexican-American children. *American Journal of Community Psychology* **15**(4), 375–385.
- Johnson, D. L. and Walker, T. (1991) A follow-up evaluation of the Houston Parent-Child Development Center: school performance. *Journal of Early Intervention* **15**(3), 226–236.
- Joshi, H. and Davies, H. (1992) *Childcare and Mothers' Lifetime Earnings: Some European Contracts*. CEPR discussion paper No. 600. CEPR, London.
- Judge, K. and Benzeval, M. (1993) Health inequalities, new concerns about the children of single mothers. *British Medical Journal* **306**, 677–680.
- Kammerman, S. B. (1993) International perspectives on child care policies and programs. *Pediatrics* **91**(1), 248–252.
- Kirby, R. S., Swanson, M. E., Kelleher, K. J., Bradley, R. H. and Casey, P. H. (1993) Identifying at-risk children for early intervention services: lessons from the Infant Health and Development Program. *Journal of Pediatrics* **122**, 680–686.
- Kraemer, H. C. and Fendt, K. H. (1990) Random assignment in clinical trials: issues in planning (Infant Health and Development Program). *Journal of Clinical Epidemiology* **43**, 1157–1167.
- Lazar, I., Darlington, R., Murray, H., Royce, J. and Snipper, A. (1982) Lasting effects of early education: Report from the Consortium for Longitudinal Studies. *Monographs of the Society for Research in Child Development* **47** (Serial No. **195**, No. 2–3), 1–150.
- Logan, C. (1972) Evaluation research in crime and delinquency: a reappraisal. *Journal of Criminal Law, Criminology and Police Science* **63**(3), 378–387.
- Martin, S. L., Ramey, C. T., Ramey, S., Wasik, B. H., Ramey, C. T., Bryant, D. M. and Sparling, J. J. (1990) The prevention of intellectual impairment in children of impoverished families: findings of a randomised trial of educational day care. *American Journal of Public Health* **80**(7), 844–847.
- McCarton, C. M., Brooks-Gunn, J., Wallace, I. F., Bauer, C. R., Bennett, F. C., Bernabaum, J. C., Broyles, S., Casey, P., McCormick, M. C., Scott, D. T., Tyson, J., Tonascia, J. and Meinert, C. L. (1997) Results at age 8 years of early intervention for low birth weight premature infants. *JAMA* **277**(2), 126–132.
- McCormick, M. C., Brooks-Gunn, J., Shapiro, S., Benasich, A. A., Black, G. and Gross, R. T. (1991) Health care use among young children in day care. Results in a randomised trial of early intervention. *JAMA* **265**(17), 2212–2217.
- McCormick, M. C., McCarton, C., Tonascia, J. and Brooks-Gunn, J. (1993) Early educational intervention for very low birth weight infants: results from the Infant Health and Development Program. *Journal of Pediatrics* **123**(4), 527–533.
- McGuire, J. and Richman, N. (1986) The prevalence of behaviour problems in three types of pre-school group. *Journal of Child Psychology and Psychiatry* **34**, 455–472.
- Melhuish, E. C. and Moss, P. (1990) *Day Care for Young Children: International Perspective*. Routledge, London.
- Meltzer, H. (1994) *Day Care services for Children. A Survey carried out on Behalf of the Department of Health in 1990*. HMSO, London.
- National Institute of Child Health and Human Development (1996) *Infant Child Care and Attachment Security: Results of the NICHD Symposium*. International Conference on Infant Studies. Providence.
- Newpin (1993) *Publicity Brochure*. Newpin, London.
- Oakley, A. (1992) *Social Support and Motherhood*. Basil Blackwell, Oxford.
- Oakley, A., Fullerton, D. and Holland, J. (1995a) Behavioural interventions for HIV/AIDS prevention. *AIDS* **9**, 479–486.
- Oakley, A., Fullerton, D., Holland, J., Arnold, S., France-Dawson, M., Kelley, P. and McGrellis, S. (1995b) Sexual health interventions for young people: a methodological review. *British Medical Journal* **310**, 158–162.
- Oakley, A. and Fullerton, D. (1996) The lamp-post of research: support or illumination? In *Evaluating Social*

- Interventions*, eds. Oakley and Roberts. Barnardos, Ilford, Essex.
- Oakley, A. and Roberts, H. (1996) *Evaluating Social Interventions*. Barnardos, Ilford, Essex.
- Oakley, A. and Roberts, I. (1996) *A Feasibility Study for a Randomised Controlled Trial of Day-care* (in press).
- Oakley, A., Rajan, L. and Turner, H. (forthcoming) *Evaluating Parent-support Initiatives: Lessons from two Case-studies*.
- Palmer, F. H. and Siegel, R. J. (1977) Minimal intervention at ages two and three and subsequent intellectual changes. In *The Pre-school in Action: Exploring Early Childhood Programs*, eds. M. C. Day and R. K. Parker, 2nd edn. Allyn and Bacon, Boston.
- Prendeville, W., Elbourne, D. and Chalmers, I. (1988) The effects of routine oxytocic administration in the management of the third stage of labour and an overview of the evidence from controlled trials. *British Journal of Obstetrics and Gynaecology* **95**, 3–16.
- Pugh, G., De'Ath, E. and Smith, C. (1994) *Confident Parents, Confident Children*. National Children's Bureau, London.
- Ramey, C. T. and Smith, B. (1976) Assessing the intellectual consequences of early intervention with high risk infants. *American Journal of Mental Deficiency* **81**(4), 318–324.
- Ramey, C. T. and Haskins, R. (1981) The causes and treatment of school failure: Insights from the Carolina Abecedarian Project. In *Causes and Prevention of Retarded Development in Psycho-socially Disadvantaged Children*, eds. M. Garber Begab and H. C. Haywood, pp. 89–112. University Park Press, Baltimore.
- Ramey, C. T., MacPhee, D. and Yeates, K. O. (1982) Preventing developmental retardation: a general systems model. In *Facilitating Infant and Early Childhood Development*, eds. L. Bond and J. Joffe. University Press of New England, Hanover, N.H.
- Ramey, C. T., Yeates, K. O. and Short, E. J. (1984a) The plasticity of intellectual development: insights from preventive intervention. *Child Development* **55**, 1913–1925.
- Ramey, C. T. and Campbell, F. A. (1984b) Preventive education for high-risk children: cognitive consequences of the Carolina Abecedarian Project. *American Journal of Mental Deficiency* **88**(5), 515–523.
- Ramey, C. T., Bryant, D. M. and Suarez, T. M. (1985) Pre-school compensatory education and the modifiability of intelligence: a critical review. In *Current Topics in Human Intelligence*, ed. D. K. Detterman. Ablex, Norwood, N.J.
- Ramey, C. T., Bryant, D. M., Wasik, B. H., Sparling, J. J., Fendt, K. H. and LaVange, L. M. (1992) Infant Health and Development Program for low birth weight, premature infants: program elements, family participation, and child intelligence. *Pediatrics* **89**(3), 454–465.
- Roberts, I. (1996) Out-of-home day care and health. *Archives of Disease in Childhood* **74**, 73–76.
- Roberts, J. E., Rabinowitch, S., Bryant, D. M., Burchinal, M. R., Koch, M. A. and Ramey, C. T. (1989) Language skills of children with different pre-school experiences. *Journal of Speech and Hearing Research* **32**(4), 773–786.
- Schulz, K. F., Chalmers, I., Hayes, R. J. and Altman, D. G. (1995) Empirical evidence of bias. *JAMA* **273**(5), 408–412.
- Schweinhart, L. J., Barnes, H. V. and Weikart, D. P. (1993) *Significant Benefits: The High/Scope Perry Preschool Study through Age 27*. High/Scope Press, Michigan.
- Seitz, V. (1990) Intervention programs for impoverished children: a comparison of educational and family support models. *Annals of Child Development* **7**, 73–103.
- Shepherd, J. P. and Farrington, D. (1995) Preventing crime and violence. *British Medical Journal* **310**, 271–272.
- Sommer, D. (1992). *A Child's Place in Society: New Challenges for the Family and Day Care Children and Society*, Vol. 6. pp. 317–335.
- Spiker, D., Ferguson, J. and Brooks-Gunn, J. (1993) Enhancing maternal interactive behaviour and child social competence in low birth weight, premature infants. *Child Development* **64**, 754–768.
- Sroufe, L. A., Egeland, B. and Kreutzer, T. (1990) The fate of early experience following developmental change: longitudinal approaches to individual adaptation in childhood. *Child Development* **61**, 1363–1373.
- Stone, W. L., Bendell, D. and Field, T. M. (1988) The impact of socio-economic status on teenage mothers and children who received early intervention. *Journal of Applied Developmental Psychology* **9**, 391–408.
- IHDP (1990) *Enhancing the outcomes of low-birth-weight, premature infants. A multisite, randomized trial. The Infant Health and Development Program. JAMA* **263**(22), 3035–3042.
- Wasik, B. H., Ramey, C. T., Bryant, D. M. and Sparling, J. J. (1990) A longitudinal study of two early intervention strategies: Project CARE. *Child Development* **61**(6), 1682–1696.
- Yogman, M. W., Kindlow, D. and Earls, F. (1995) Father involvement and cognitive/behavioural outcomes of pre-term infants. *Journal of American Academy of Child and Adolescent Psychiatry* **34**, 158–165.
- Yoshikawa, H. (1994) Prevention as cumulative protection: effects of early family support and education on chronic delinquency and its risks. *Psychological bulletin* **115**(1), 28–54.
- Zigler, E. and Weiss, H. (1985) Family support systems: an ecological approach to child development. *Rapport: Children, Youth and Families: The Action-Research Relationship*, pp. 166–205.