

Primary care

Effectiveness of out-of-home day care for disadvantaged families: randomised controlled trial

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Abstract

Objective To assess the effects of providing daycare facilities for young children on the health and welfare of disadvantaged families.

Design Randomised controlled trial. Eligible children from the application list to a daycare facility were randomly allocated to receive a daycare place or not.

Setting Early Years daycare centre in Borough of Hackney, London.

Participants 120 mothers and 143 eligible children (aged between 6 months and 3.5 years).

Intervention A place at the centre, which provided high quality day care. Control families used other child care that they secured for themselves.

Main outcome measures Maternal paid employment, household income, child health and development.

Results At 18 months' follow up, 67% of intervention group mothers and 60% of control group mothers were in paid employment (adjusted risk ratio 1.23 (95% confidence interval 0.99 to 1.52)), but were no more likely to have a weekly household income of above £200 (risk ratio 0.88 (0.70 to 1.09)).

Intervention group children had more otitis media with effusion (risk ratio 1.74 (1.02 to 2.96)) and used more health services (1.58 (1.05 to 2.38)), but both estimates were imprecise.

Conclusion The provision of child day care may have increased maternal employment, but it did not seem to increase household income. The results suggest that providing day care may be insufficient as a strategy to reduce poverty. The study shows how random allocation can be used to ration and evaluate interventions where demand exceeds supply.

Introduction

Poor children are at increased risk for adverse health and social outcomes. In 2000, 4.5 million UK children were living in poor households (household income of less than 50% of the national average, excluding housing costs and adjusting for family size).¹ Unemployment is an important cause of family poverty, and 20% of UK children live in a household with no one in paid work. Lone parents are particularly likely to be without paid work.²

Reducing child poverty is a key government objective.³ Better access to out-of-home daycare facilities for children is considered to be an important anti-poverty

strategy, since it might enable poor parents to take up paid work, thus increasing household income. It might also provide mothers with opportunities for further education, which could improve their future employment. However, there is little experimental evidence about the effects of day care on the lives of disadvantaged families.⁴

Day care may have direct effects on the health of poor children. For example, by providing a safe environment for children, it may reduce injury rates.⁵ It can also have a beneficial effect on child development and behaviour: a systematic review of eight randomised controlled trials showed that day care improves child development and may reduce antisocial behaviour.⁶ On the other hand, there may be adverse health effects. Observational studies suggest that attendance at day care increases the risk of respiratory infection and otitis media with effusion.⁷⁻¹⁰ Prolonged otitis media with effusion can cause moderate hearing loss, which could delay a child's acquisition of language.

To evaluate the effects of providing high quality day care to disadvantaged families, we conducted a randomised controlled trial. In this paper we report the results of the trial for family and child outcomes (the process and economic evaluations that we also conducted will be reported separately).

Participants and methods

The trial was conducted at a new Early Years centre on the Holly Street Estate in the London Borough of Hackney. The demand for daycare places at the new centre greatly exceeded the number of places available, and, in response to a request from the trial team, the borough's education department agreed to use random allocation as the method of rationing places. Families living within the catchment area who had applied for a place at the centre for a child aged between 6 months and 3.5 years were invited to take part. All available places were randomly allocated, whether or not a family agreed to take part in the trial, and those who had consented to participate were followed up for 18 months.

Intervention

The intervention was high quality flexible day care for children under 5 years old. The quality of day care depends on several attributes, of which the integration

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of care and education is particularly important. Unlike standard nursery care in Hackney, the Early Years centre employed qualified teachers, and education was integrated into the care of the children. The integration of health and social services was also encouraged. The centre was unusual in offering parents full time or part time places, with the option to change depending on circumstances. It also offered extended care outside the normal nursery times for working parents. The centre exceeded the national requirements for other standard indicators of care such as staff qualifications and staff to child ratios. Independent assessments carried out with the early childhood environment rating scale, a validated instrument for assessing early childhood settings, showed that the centre scored highly compared with others in Britain. The centre was designated by the government to be an "early excellence centre," to act as a model of good practice in childcare provision. Further details about the centre are presented elsewhere.¹¹

Control group families were expected to use a range of childcare provision that they secured for themselves, including other daycare facilities. However, demand for daycare places in Hackney was greatly in excess of supply, with about eight children for every available place.¹² We therefore expected that most of the child care used by the control group would be part time places at nursery schools (to which all children are entitled after 3 years old) or care given by parents, childminders, family, or friends.

Randomisation

The family was the unit of randomisation, and all children in the same family were offered a place at the Early Years centre. Most families were randomised at the start of the trial, when the centre opened. Subsequently randomisation was conducted at intervals when daycare places became available. The intervention:control ratio varied between 1:1 and 1:2 according to the availability of places at the centre.

The allocation sequence was computer generated, and we used minimisation to provide a reasonable balance on three potential confounders (size of family, lone parenthood, and whether the application was for a full fee paying or subsidised place). Eligible families were given a unique family identification number, and an independent statistician entered these numbers into the minimisation software to determine which families would be offered a place at the centre. The allocation was sent to the centre, where administrative staff matched the identification numbers with the corresponding names and sent letters to the applicants advising them of their allocation status.

Sample size

The primary outcome was maternal paid employment at 18 months' follow up. On the basis of a feasibility study, we estimated the baseline proportion of employed mothers to be 40%.¹³ Economic studies have suggested that day care may increase maternal paid employment (full time and part time) by more than 25% (that is, from 40% to 65%).^{14 15} Data on supply and demand of day care in Hackney at the start of the study period led us to anticipate that it would be difficult for control group families to find alternative daycare facilities, and that the services they might find were likely to provide short "sessional" day care that would

be incompatible with paid employment. Therefore, to detect an effect of the size suggested by these studies (25%), with a statistical power of 80% at $\alpha=0.05$, we aimed to recruit 140 families.

Outcomes and data collection

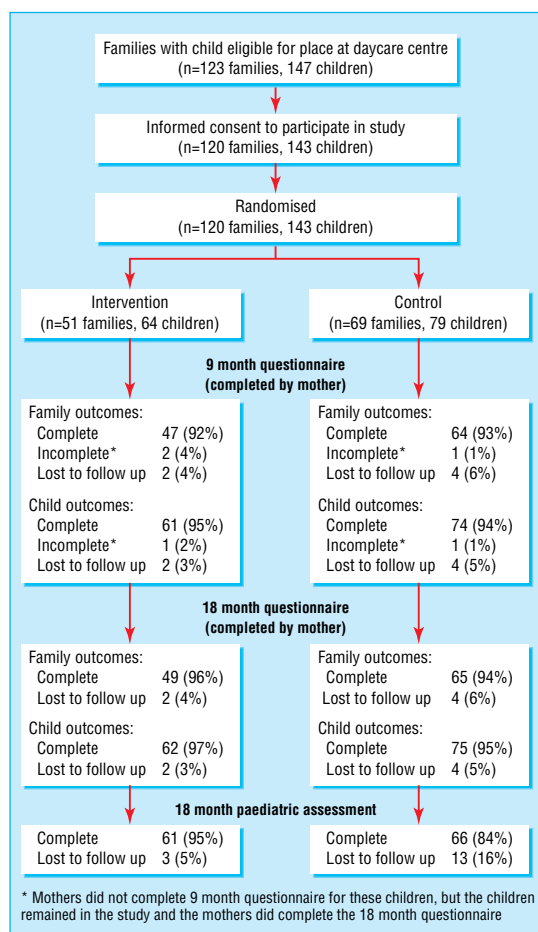
Family outcomes—We asked mothers about paid employment (in paid work or on maternity leave versus not in paid work) and about hours per week in paid work. We asked mothers to choose an income range within which their weekly household income fell, including take-home pay and benefits. We assessed mothers' psychological health using the general health questionnaire 12, and we asked them if they had been on educational courses in the previous six months, how many close friends they had, and whether they smoked.

Child outcomes included mental development, assessed with the Griffiths mental developmental scales. We asked parents whether their children had experienced any injuries in the previous month and what infections their children had experienced in a one week recall period. We recorded use of preventive health services and immunisations at the final paediatric assessments. We examined children's ears at 18 months using a tympanometer to identify otitis media with effusion. Tympanograms were assessed independently by two paediatricians. We also recorded use of child care at 18 months.

At baseline, mothers completed questionnaires on child and family outcomes, and the study paediatricians collected data on child development. At nine months' follow up, we collected process and cost data using questionnaires administered during interviews. At 18 months' follow up, we sent postal questionnaires to participating families, and children were assessed by a paediatrician who was not informed of their group status. Data entry was blind to group allocation.

Statistical analysis

Analyses were on an intention to treat basis. An analysis plan describing how each variable was to be analysed was sent to the funding body before data analysis. To increase precision and adjust for chance imbalance at baseline, we used analysis of covariance to adjust analyses of all follow up variables for the baseline measurement of that variable, where this information had been collected. Hours worked by mothers at 18 months' follow up were adjusted for a binary variable indicating whether any hours had been worked at baseline, since the exact number of hours was not collected. Women who were on maternity leave at baseline were considered not to have worked any hours. We used generalised linear models with a log link to estimate adjusted risk ratios for binary outcomes. For child outcomes, we used the Huber-White sandwich estimator of variance to obtain robust standard errors that assume only that outcome variables from different families are conditionally independent. We used non-parametric bootstrap confidence intervals (allowing for non-independence of results from children in the same family) for highly skewed continuous outcome and cost data. Analyses were carried out in STATA (Stata Corporation, College Station, Texas, USA).



Flow of participants through study

Results

We recruited suitable families from January 1999 to April 2000. The figure shows the flow of participants through the study: 120 families (51 intervention, 69 control) agreed to provide data for the study, including 143 children (64 intervention, 79 control). Table 1 shows the participants' characteristics at baseline. The final ratio of intervention families to control families was 1:1.4.

Outcomes

Table 2 shows data on maternal and family outcomes. At 18 months' follow up, 67% of mothers in the intervention group were in paid work compared with 60% in the control group (risk ratio adjusted for baseline 1.23 (95% confidence interval 0.99 to 1.52)). Mothers in the intervention group worked more hours per week than those in the control group (adjusted mean difference 7.57 (2.00 to 13.75)) and were less likely to have a household weekly income of above £200 (risk ratio adjusted for baseline 0.88 (0.70 to 1.09)).

Table 3 shows data on child outcomes. Children in the intervention group had a slightly higher mean score for mental development than control group children, but the estimate was imprecise (adjusted mean difference 2.89 (-1.64 to 7.41)). Sixty five per cent of intervention group children had experienced an infection in the previous week compared with 71% of control children (risk ratio 0.91 (0.72 to 1.16)). However, intervention group children were more likely to have evidence of otitis media with effusion in one or both

ears (risk ratio 1.74 (1.02 to 2.96)) and were more likely to have visited a health practitioner in the previous month (risk ratio 1.58 (1.05 to 2.38)), although the results are imprecise. Reliability of diagnosis of otitis media with effusion by the two paediatricians was high ($\kappa = 0.96$).

Use of daycare facilities

The mean time that children in the intervention group attended the daycare centre over the study period was 211 days. At the end of follow up, 92% (57/62) of the intervention group children were in some type of centre based day care (including attendance at a local authority, community, or private nursery or at a nursery unit attached to a school) compared with 63% (47/75) of control group children. Of these 47 control group children in formal day care, 23 (49%) were attending a nursery unit attached to a local authority school (see table 4). Unlike the care offered by local authority, community, or private nurseries, nursery units attached to schools offer only part time day care, usually a 2.5 hour morning session or a 2.5 hour afternoon session. No extended day care or holiday care is provided.

Discussion

A higher proportion of mothers in the intervention group were in paid employment than in the control group mothers, but the effect estimates were imprecise and the results are compatible with chance. Intervention group mothers worked more hours than control group mothers, but again the estimates were imprecise. Despite the trend towards more paid employment, there was no evidence that intervention mothers had a higher household income. Children in the intervention group were more likely to have otitis media with effusion and to have used more health services.

Strengths and weaknesses of study

Allocation was well concealed, and follow up rates were high (95%). Participants provided outcome data with self completed questionnaires, and the researchers who collected and entered the data were blind to the participants' allocation status. At the paediatric

Table 1 Baseline characteristics of mothers and children according to whether children were provided with high quality flexible day care (intervention). Values are numbers (percentages) unless stated otherwise

	Intervention group	Control group
Mothers		
Mothers completed baseline questionnaire	n=49	n=61
In paid employment (part time or full time)	25/47 (53)	36/59 (61)
Mean (SD) age when left full time education (years)	19.2 (4.0)	19.5 (3.3)
Mean (SD) age (years)	31.4 (6.1)	32.2 (5.4)
Total weekly household income >£200	19/45 (42)	21/56 (38)
Claiming means tested benefit*	30/49 (61)	30/61 (49)
Non-white ethnicity	28/47 (60)	38/60 (63)
Current smoker	10/48 (21)	15/61 (25)
Mean (SD) general health questionnaire 12 score	11.9 (5.9)	12.7 (6.4)
Living with partner	23/47 (49)	34/59 (58)
Children		
Mothers completed baseline questionnaire	n=62	n=72
Mean (SD) age (months)	25.5 (10.1)	25.7 (10.2)
Mean (SD) birth weight (g)	3200 (600)	3300 (500)
Mean (SD) quotient for Griffiths mental developmental scales	106.6 (19.0)	101.7 (18.6)

*Income support, job seekers' allowance, housing benefit.

Table 2 Maternal and family outcomes at 18 months' follow up according to whether children were provided with high quality flexible day care (intervention). Values are numbers (percentages) unless stated otherwise

	Intervention	Control	Point estimate* (95% CI)
In paid employment (part time or full time)	33/49 (67)	39/65 (60)	RR 1.23 (0.99 to 1.52)
Mean (SD) hours worked in previous week	14.8 (17.8)	11.4 (15.5)	MD 7.57 (2.00 to 13.75)†
In education in previous 6 months	18/49 (37)	24/65 (37)	RR 0.99 (0.61 to 1.62)*
Total weekly household income >£200	21/49 (43)	32/64 (50)	RR 0.88 (0.70 to 1.09)
Claims means tested benefit	25/49 (51)	34/65 (52)	RR 0.95 (0.71 to 1.27)
Has tenure (owns or part owns housing)	15/49 (31)	20/65 (31)	RR 0.99 (0.61 to 1.58)
Health in previous month good	39/49 (80)	52/65 (80)	RR 1.02 (0.85 to 1.23)
Mean (SD) general health questionnaire 12 score	10.8 (5.2)	10.8 (6.0)	MD 0.10 (-2.16 to 2.35)
Used medication for depression in previous week	3/49 (6)	4/65 (6)	RR 0.99 (0.23 to 4.24)*
Current smoker	14/49 (29)	19/65 (29)	RR 0.97 (0.75 to 1.24)
Has many close friends	5/49 (10)	13/65 (20)	RR 0.51 (0.19 to 1.34)*
Receives help from family	29/49 (59)	39/65 (60)	RR 0.99 (0.73 to 1.34)*

*Risk ratio (RR) for binary outcomes, mean difference (MD) for continuous outcomes. Point estimates are adjusted for baseline values. Where baseline information on variable was not collected, unadjusted estimates are shown and are marked with an asterisk.

† Bootstrap 95% CI to correct for bias.

Table 3 Child outcomes at 18 months' follow up according to whether children were provided with high quality flexible day care (intervention). Values are numbers (percentages) unless stated otherwise

	Intervention	Control	Point estimate* (95% CI)
Griffiths mental developmental scales:			
Mean (SD) quotient	110.9 (14.9)	105.9 (14.6)	MD 2.89 (-1.64 to 7.41)
Mean (SD) score for language component	111.1 (24.0)	106.1 (22.5)	MD 2.66 (-4.98 to 10.29)
Mean (SD) score without locomotor component	110.3 (16.8)	105.4 (15.7)	MD 2.78 (-2.31 to 7.87)
Mother feels child is not developing normally	3/62 (5)	3/75 (4)	RR 1.19 (0.27 to 5.22)
Injury that needed medical attention in previous month	2/62 (3)	4/75 (5)	RR 0.60 (0.12 to 3.09)*
Infection or illness in previous week	40/62 (65)	53/75 (71)	RR 0.91 (0.72 to 1.16)*
Contact with health professional in previous month	34/62 (55)	26/75 (34.7)	RR 1.58 (1.05 to 2.38)*
Child health promotion reviews up to date†	41/58 (71)	50/66 (76)	RR 0.93 (0.74 to 1.17)*
Otitis media with effusion in one or both ears	22/48 (46)	14/53 (26)	RR 1.74 (1.02 to 2.96)*
Immunisations up to date	52/58 (90)	56/66 (85)	RR 1.06 (0.91 to 1.23)*

*Risk ratio (RR) for binary outcomes, mean difference (MD) for continuous outcomes. Point estimates are adjusted for baseline values. Where baseline information on variable was not collected, unadjusted estimates are shown and are marked with an asterisk.

†Parents in Hackney are encouraged to bring their children to a series of preventive "child health promotion" reviews when children are aged 6 weeks, 3 months, 8 months, and 2.5 years.

assessments, some parents talked about their childcare arrangements, and so we cannot exclude the possibility of bias in the assessment of child development. However, such a bias is unlikely for the results for otitis media, as the two paediatricians examined the printed tympanograms without any identifying information. Although the ratio of intervention to control families varied over the course of recruitment, this is unlikely to have resulted in bias since the availability of daycare places is not expected to have been related to any outcome variable.

The main study weakness is the lack of power because of our inability to achieve a sufficiently large sample size. This was an opportunistic evaluation of an anti-poverty strategy in a deprived inner city setting in

which randomisation was possible because of the need to ration the available daycare places. Although the educational authority agreed to the use of random allocation as the rationing method, we were constrained in the number of places that we could offer within the project timeframe.

At the outset we understood that 70 places would be available when the daycare centre opened, with the possibility of more places becoming available later. However, during the study it became apparent that there were fewer places than anticipated, and only 64 daycare places were eventually allocated. Hackney is highly disadvantaged and has a large refugee population,¹⁶ and some places at the centre were reserved for families in emergency situations and for referrals from social services. The need to keep some places available to ensure flexibility to accommodate families' changing requirements for day care also meant that the centre was never running at its maximum capacity. Lastly, the need to implement the local policy that children in the same family should be offered a place at the same daycare facility resulted in a lack of independence of child outcome data, which also reduced power.

At 18 months' follow up, many children in the control group were using some type of centre based day care. The context of the trial was a severe shortage of daycare facilities in Hackney with long waiting times, and it is unlikely that the control families had access to formal day care for most of the trial period. Moreover,

Table 4 Children's use of child care at 18 months' follow up according to whether children were provided with high quality flexible day care (intervention). Values are numbers (percentages) unless stated otherwise

Type of day care	Intervention group (n=62)	Control group (n=75)
Centre based care:	57 (92)	47 (63)
Community nursery	1 (2)	4 (5)
Private nursery	4 (6)	7 (9)
Local authority nursery	43 (69)	13 (17)
Nursery unit attached to local authority school	9 (15)	23 (31)
By family	9 (15)	10 (13)
By friends or relatives	4 (6)	3 (4)
By childminder	6 (10)	15 (20)

most of the centre based day care available to control children was at school nursery units offering part time day care without the flexibility needed to allow for maternal employment. None the less, the fact that many control children did receive formal day care would have resulted in smaller intervention effects than if the control group had had no day care.

Relationship of the data to other studies

There is little experimental evidence on the effects of child day care on maternal employment and no randomised controlled trials in the United Kingdom. Although our results suggest an increase in paid employment among intervention mothers, the lack of evidence of a corresponding increase in household income may reflect the fact that wages are low for jobs for which mothers in Hackney are eligible. Furthermore, women who enter paid employment or who increase their hours of paid work may experience a reduction in their entitlement to welfare benefits, such as housing benefit or working families' tax credit. Our results support findings from other studies that suggest that mothers' decisions to enter the labour market may not be motivated solely by immediate financial returns. Instead, there may be other benefits, such as maximising long term earning potential, relief from full time child care, or job satisfaction.^{17 18} Similar effects of day care on paid employment and household income may be expected in other disadvantaged areas of Britain, where unemployment is high and there is a large unmet need for daycare facilities. However, the extent to which these results are generalised to less deprived areas is open to question.

Our results are consistent with observational studies in showing that daycare attendance increases the risk of otitis media with effusion, although we found no evidence of delay in language acquisition or behavioural problems. Observational studies have also shown that day care increases the risk of infection, but we found no evidence of this, although we did find a suggestion of greater use of health services. An objective of the Early Years centre was to integrate children's care with health services, and preventive health care was actively encouraged. However, we found no effect on the use of preventive health services, as measured by immunisation status and uptake of child health promotion reviews, although this may have resulted from a lack of study power. We were unable to determine whether the increase in health service use we found was due to greater illness or to greater use of preventive or routine services that were not detected.

Policy implications and future research

This trial provides some support for government initiatives based on the belief that daycare provision can increase maternal employment. However, our results question the assumption implicit in many such initiatives—that paid employment provides an immediate route out of poverty by increasing household income. Tackling low pay, changing the benefit structure, and reducing the costs of day care to poor families may be equally important components of an anti-poverty strategy. Although this was a small trial, it shows that evaluation of anti-poverty interventions is possible in situations where the demand for the intervention exceeds supply and the intervention must be rationed.¹⁹

What is already known on this topic

Reducing poverty in families with children is a key government objective

Daycare provision is considered essential to reducing family poverty because it allows mothers with young children to enter paid employment

What this study adds

This randomised controlled trial found that daycare provision increased maternal paid employment but found no evidence that this increased family income

In addition to providing daycare places, policies to reduce family poverty must also tackle low pay and the benefit structure

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